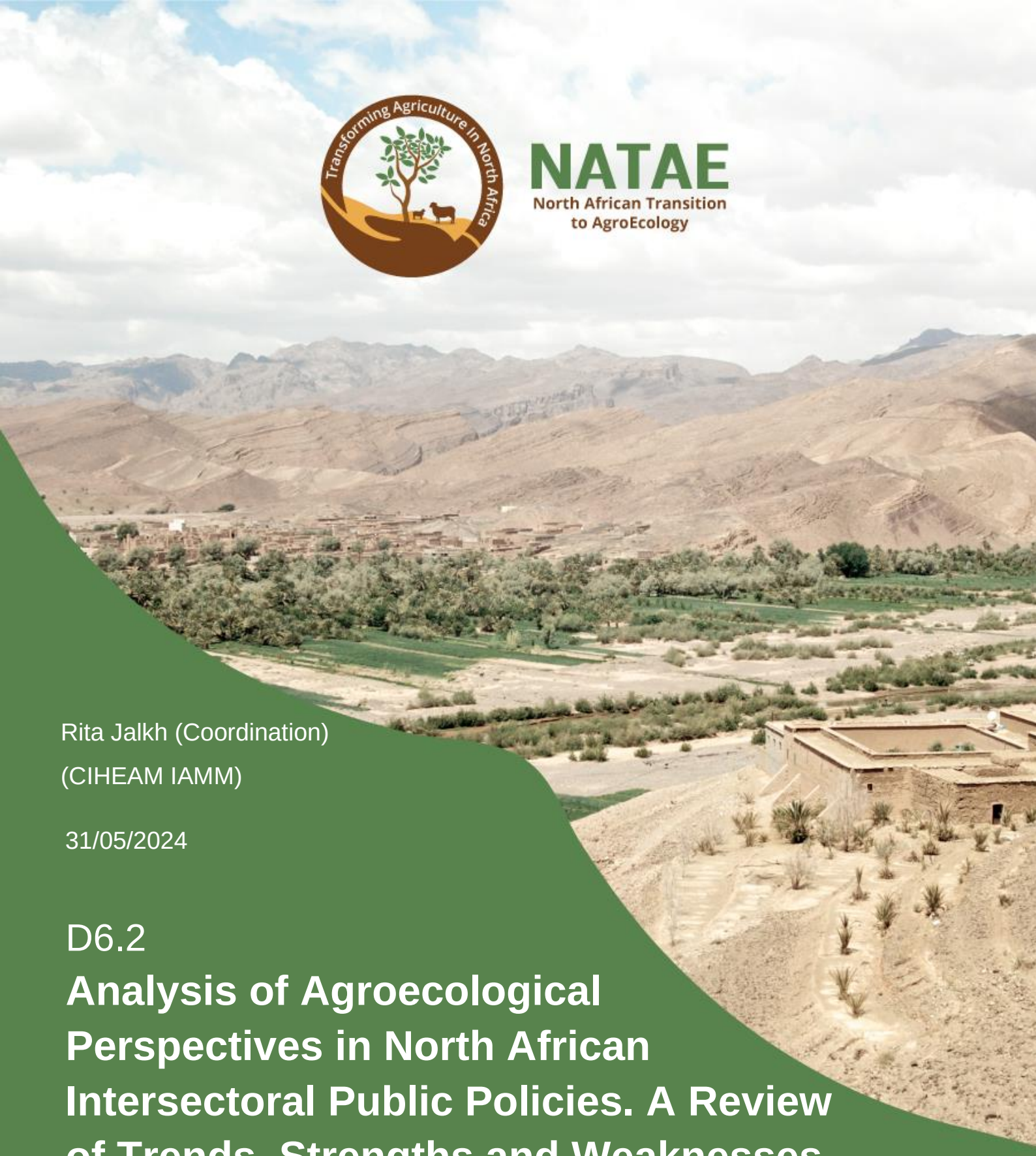

Rita Jalkh (Coordination)

(CIHEAM IAMM)

31/05/2024

D6.2

Analysis of Agroecological Perspectives in North African Intersectoral Public Policies. A Review of Trends, Strengths and Weaknesses

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Funded by the European Union

This project is funded by the European Union under the Grant Agreement no. 101084647. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them. For the associated partner in the NATAE project, this work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

Document Control Sheet

Project Number	101084647		
Project Acronym	NATAE		
Project Full title	Fostering agroecology transition in North Africa through multi-actor, evaluation, and networking		
Project Start Date	1 December 2022		
Project Duration	48 months		
Funding Instrument	Horizon Europe	Funding Scheme	Research and Innovation Action (RIA)
Topic	HORIZON-CL6-2022-FARM2FORK-01		
Coordinator	Mélanie Requier-Desjardins (requier@iamm.fr)		

Deliverable Information

Deliverable No	**D6.2**
Deliverable Title	Analysis of Agroecological Perspectives in North African Intersectoral Public Policies. A Review of Trends, Strengths and Weaknesses
Work-Package No	WP6
Work-Package Title	EU-compliant policies to foster AE transition in North African countries
WP-Leader (Name and Short Org. Name)	ZALF
Task No	T6.1
Task Title	Inter-sectoral policy review
Task Leader (Name and Short Org. Name)	CIHEAM IAMM
Main Author (Name and Short Org. Name)	Rita Jalkh (CIHEAM IAMM)
Other Authors (Name and Short Org. Name)	Melanie Requier-Desjardins, Omar Bessaoud and Tahani Abdelhakim, Elen Lemaître-Curri (CIHEAM IAMM), Inès Zouari, Salma Jallouli, Youssef Trifa, and Mehdi Ben Mimoun (INAT), Cheikh Sidya Fall (GRDR), Taha Lahrech (IAV Hassan II), Gamal Siam (expert, University of Cairo), Amel Bouzid, Fatah Ameur, Karima Boudedja, Amine Oulmane, and Aissa Belhadi (CREAD), Ali Daoudi, Sami Assassi, and Manel Nechar (ENSA) Dario Pollicino and Simon Julien (IUCN)
Reviewers (Name and Short Org. Name)	Seyed-Ali Hosseini-Yekani (ZALF)
Status	Draft ☒ Final ☐
Deliverable Type	Report ☒ Data ☐ Demonstration ☐ Other ☐

Dissemination Level	Public (PU) ☒ Sensitive (SEN) ☐ Classified ☐ PU: Public, fully open SEN: Sensitive, limited under the conditions of the Grant Agreement Classified R-UE/EU-R – EU RESTRICTED under the Commission Decision No2015/444 Classified C-UE/EU-C – EU CONFIDENTIAL under the Commission Decision No2015/444 Classified S-UE/EU-S – EU SECRET under the Commission Decision No2015/444
Date Approved by Coordinator	

Versioning and Contribution History

Version	Date	Author/Editor	Contributors	Description/Comments
1.0	07/2024	Rita Jalkh (CIHEAM IAMM	Tahani Abdelhakim, Omar Bessaoud (CIHEAM IAMM)	Methodology for the elaboration of national reports
2.0	02/2024	Inès Zouari, Salma Jallouli, and Youssef Trifa (INAT), Cheikh Sidya Fall (GRDR), Taha Lahrech (IAV Hassan II), Gamal Siam (expert, University of Cairo), Amel Bouzid, Fatah Ameur, Karima Boudedja, Amine Oulmane, and Aissa Belhadi (CREAD), Ali Daoudi, Sami Assassi, and Manel Nechar (ENSA)	Tahani Abdelhakim, Omar Bessaoud, Mélanie Requier-Desjardins, Rita Jalkh (CIHEAM IAMM)	National reports formulation
3.0	27/03/2024	Rita Jalkh (CIHEAM IAMM)	Omar Bessaoud Tahani Abdelhakim (CIHEAM IAMM)	Creation of transversal document structure and first entries
4.0	24/04/2024	Rita Jalkh (CIHEAM IAMM)	Omar Bessaoud Tahani AbdelhakimMélanie Requier-Desjardins (CIHEAM IAMM)	First draft of transversal analysis
5.0	15/05/2024	Rita Jalkh (CIHEAM IAMM)	Mélanie Requier-Desjardins (CIHEAM IAMM)	Second draft of transversal analysis
6.0	31/05/2024	Rita Jalkh (CIHEAM IAMM)	Mélanie Requier-Desjardins (CIHEAM IAMM)	Finalization and editing

To cite this Deliverable: Jalkh R. (Coord)., Bouzid A., Siam G., Lahrech T., Sidya-Fall C., Zouari I., Pollicino D., Lemaitre-Curri E., Bessaoud O., Abdelhakim T., Requier-Desjardins M. (2024). Analysis of Agroecological Perspectives in North African Intersectoral Public Policies. A Review of Trends, Strengths and Weaknesses. NATAE project report, EU Horizon Grant Agreement no. 101084647. https://doi.org/10.5281/zenodo.12770882

This research has been carried out under the NATAE project (Horizon Europe: ID 101084647): "Fostering agroecology transition in North Africa through multi-actor evaluation and networking" funded by the European Union. This work has also received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI). The authors acknowledge all local partners who have participated in this work and share their thanks for their contribution, efforts and knowledge in the process of this reflection and in making this publication possible. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the granting authority.

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Glossary

Abbreviation	Full form
%	Percentage
ACF	Action Against Hunger
ACTA	Agricultural Land Development and Conservation
ADF / FDA	Agricultural Development Fund
AE	Agroecology
AECID	Spanish Agency for International Development Cooperation
AFD	French Development Agency
AGDP	Agricultural Gross Domestic Product
AGSPS	Strategy for Accelerated Growth and Shared Prosperity
AMAD	Mauritanian Association for Self-Development
ANSADE	National Agency for Statistics and Demographic and Economic Analysis
AP2-AGSPS	Second action plan (2021-2025) of the Accelerated Growth and Shared Prosperity Strategy
APIM	Mauritania Investment Promotion Agency
APOL	Agropastoral Orientation Law
ARC	Agricultural Research Center
ASTI	Agricultural Science and Technology Indicators
AT	Technical Support
AU	African Union
bcm	Billion cubic meters
CAGR	Average Annual Growth Rate
CAS	Trusted accounts (Comptes d'affectation spéciale)
CBD	Convention on Biological Diversity
CC	Climate change
CCFD-TS	Catholic Committee Against Hunger and for Development - Terre solidaire
CEOSS	Coptic Evangelical Organization for Social Services
CERAI	Centre for Rural Studies and International Agriculture
CES	Water and Soil Conservation
CGIAR	Consultative Group on International Agricultural Research
CIHEAM-IAMM	Mediterranean Agronomic Institute of Montpellier / Centre Internationale des Hautes Etudes Agronomiques Méditerranées - Institut Agronomique Méditerranéen de Montpellier
CIRAD	Centre for International Cooperation in Agricultural Research for Development
cm	Cubic Meter
CREAD	Centre de Recherche en Economie Appliquee pour le Developpement
CSA	Climate-smart agriculture
DGAB	Directorate-General for Organic Agriculture
DGACTA	Agricultural Land Use and Conservation Branch
EBSAP	Egypt Biodiversity Strategy and Action Plan
ECODEV	NGO School of Local Development in Mauritania
EEAA	Egyptian Environmental Affairs Agency

EGP	Egyptian Pound (EGP 1 = USD 0.0323)
ENABEL	Belgian Development Agency
EPCV	Permanent Survey on Household Living Conditions
Eq CO2	Equivalent CO2
EU	European Union
FAO	Food and Agriculture Organization
Fed	Feddan (1 fed = 4200 square meter = 0.42 ha)
FTDES	Tunisian Forum for Economic and Social Rights
GAP	Good agricultural practices
GDP	Gross Domestic Product
GERD	Grand Ethiopian Renaissance Dam
GG	Green generation
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOE	Government of Egypt
GRDR	Groupe de Recherche et de réalisations pour le Dévélopement Rural
GRET	Groupe de Recherche et d'Echanges Tecnhologiques
Ha	Hectare equals 10,000m2
HLPE	High Level Panel of Experts on Food Security and Nutrition
IAV Hassan II	Institut Agronomique et Veterinaire Hassan II
ICARDA	International Centre for Agricultural Research in the Arid Zones
ICPD	International Conference on Population and Development
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
INAT	Institut National Agronomique de Tunisie
INRA	Institut National de la Recherche Agronomique
INS	National Institute of Statistics
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest management
ITES	Tunisian Institute for Strategic Studies
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resources Management
JICA	Japanese International Cooperation Agency
LL	Living Lab
MA	Ministry of Agriculture
MALR	Ministry of Agriculture and Land Reclamation
MARHP	Ministry of Agriculture, Water Resources and Fisheries
MCA	Ministry of Trade and Handicrafts
MDH	Moroccan Dirham
MEAPS	Ministry of Economic Affairs and Promotion of Productive Sectors
MESD	Ministry of Environment and Sustainable Development
MHS	Ministry of Hydraulics and Sanitation
MIND	Ministry of Industry, Energy and Mines
mm	Millimetre
MNV/MRV	Measurement, Notification and Verification/ Measurement, Reporting and Verification

MRD	Ministry of Rural Development
MRU	Mauritanian currency, (Mauritanian ouguiya)
MSEA	Ministry of State for Environmental Affairs
MWRI	Ministry of Water Resources and Irrigation
NADP	National Agricultural Development Plan
NAIP/FS	National Agricultural Investment Program / Food Security
NAPCD	National Action Plan to Combat Desertification
NARS	National Agricultural Research Strategy
NATAE	Fostering Agroecology Transition in North Africa Through Multi-actor Evaluation and Networking Project
NBSPA	National Biodiversity Strategy and Action Plan
NCARAD	National Center for Agricultural Research and Development
NCCS	National Climate Change Strategy
NDC	Nationally Determined Contribution
NEAP	National Environment Action Plan
NESDAP	National Environment and Sustainable Development Action Plan
NESDS	National Environment and Sustainable Development Strategy
NFSS	National Food Security Strategy
NGO	Non-Governmental Organization
NLCS	National Low-Carbon Strategy
NLDP	National Livestock Development Plan
NPAR	National Plan for Agricultural Research
NPSDWI	National Programme for Supply, Drinking Water and Irrigation
NRSDS	National Rural Sector Development Strategy
NSATE	National School of Agricultural Training and Extension of Kaedi
NSCRD	National Strategy for Climate-Resilient Development
NSDS	National Sustainable Development Strategy
NSO	National Statistics Office
NSSAWS	National Strategy for Sustainable Access to Water and Sanitation
NTFP	Non-Timber Forest Products
NWCS	National Wetland Conservation Strategy
NWRP	National Water Resources Plan
NWS	National Wetlands Strategy
ONAGRI	National Observatory of Agriculture
OSS	Observatoire du Sahel et du Sahara
OTEDD	Tunisian Observatory for Environment and Sustainable Development
PAN-LCD / NAP-CD	National Action Plan to Combat Desertification
PRSP	Poverty Reduction Strategy Paper
RDF / FDR	Rural Development Fund
RIM	Islamic Republic of Mauritania
ROSA	Network of Food Security Organizations
RSDS	Rural Sector Development Strategy
SADS	Sustainable Agricultural Development Strategy
SDGs	Sustainable Development Goals
SDS	Sustainable Development Strategy
SNAAT	National Society for Agricultural Development and Works

SNTE / NSET	National Strategy for Ecological Transition
SOFRECO	French company in consulting and technical assistance for sustainable economic and social development
SONADER	National Society for Rural Development
SPANB / NSAPB	National Biodiversity Strategy and Action Plan
SWC/SDR	Surface Water Conservation/ Soil Defence and Restoration
TCRPB	Training Centre for Rural Producers of Boghé
Tenmiya	Development Association in Mauritania
TEP	Total factor productivity
TFP	Technical & Financial Partners
TND	Tunisian Dinar
TVTSB	Technical and Vocational Training School of Boghé
UAA	Usable Agricultural Area
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USAID	United States Agency for Development
USD	US dollar
USD	United States Dollar (USD 1 = EGP 30.95 in January, 2024)
WB	World Bank
WFP	World Food Programme
WHO	World Health Organization
WP	Work Package
WV	World Vision
WWF	World Wide Fund for Nature

Executive Summary

This deliverable was built collectively by all the Algerian, Egyptian, Moroccan, Mauritanian and Tunisian partners under the responsibility of the project coordination team, and three experts, one Egyptian, and two international experts: it is composed of five national reports and a transversal synthesis. The national reports were structured around the following three points: a description of the agricultural and rural context with a focus on recent constraints and developments, an inventory and analysis of agricultural and environmental strategies; and finally, a set of surveys conducted among different stakeholders on the place of agroecology in public policies and in the agricultural world. The synthesis presents the results obtained on the three components in a cross-cutting manner and contextualizes them in relation to the international context and other public policy sectors such as health.

North Africa's natural resources are undergoing significant degradation for multiple reasons, the important of which are due to overexploitation of renewable water resources and climate change. The region is particularly susceptible to climate shocks and has experienced a temperature increase, reduced precipitation and water scarcity with expectations of more severe climatic conditions in the future.

Despite different contexts and specificities, North African countries share commonalities, including the economic and social importance of agriculture, varying degrees of food dependence, and high vulnerability to climate change. Current agricultural public policies do not adequately address the scarcity and fragility of natural resources, with climate change exacerbating soil and water degradation. The agricultural growth model prioritizes food security and increased production for national needs and exports, often neglecting environmental sustainability although it is progressively being highlighted in policy documents but not in their application approaches. Efforts for sustainable development are frequently disconnected from broader strategies such as environmental and health policies, and agroecology is not explicitly mentioned in national strategies. However, practices similar to agroecology are observed among family and small farmers, driven more by necessity and lower costs than by policy support.

North African countries have been more recently engaging in sustainable development initiatives especially since the 1992 Rio Earth Summit, joining international conventions and developing institutional frameworks to manage natural resources. These efforts are often supported by international cooperation and NGOs, but public policies still encourage intensive resource exploitation. While environmental actions are included in national strategies, they are typically driven by external organizations and implemented in localized projects, limiting their impact and integration into broader agricultural policies.

Agroecology faces mixed perceptions among stakeholders today, with few farmers aware of it and concerns about potential decreases in production and income. The lack of scientific knowledge and cognitive capital on agroecology, combined with the urgency of food security challenges, impedes its adoption. Despite these barriers, there are emerging initiatives and a growing market for organic products, particularly among urban consumers. The transition to agroecology requires better alignment between public policies and environmental strategies with their implementation programmes which remain dispersed today with no clear linkages between them. Therefore, a reconciling between short-term food security measures with long-term sustainable development goals is needed.

Part 1

Introduction and Context

Rita Jalkh, Melanie Requier-Desjardins, Omar Bessaoud and Tahani Abdelhakim (CIHEAM IAMM)

Other contributors: Amel Bouzid (CREAD), Ines Zouari (INAT), Gamal Siam (UoC), Cheikh Sidya-Fall (GRDR), Taha Lahrech (IAV Hassan II)

PART 1: INTRODUCTION AND CONTEXT

Chapter One General Introduction and Methodology

1.1. Introduction

The NATAE project has put in place 8 Work Packages with hopes to foster the adoption of science-based, locally-tailored and co-designed agroecological strategies in North Africa. This is planned through the creating of a comprehensive and quantitative baseline on agroecology (AE), providing a shared understanding, multidimensional performance measures, and analyses of AE potential for meeting consumers demand on the market. By setting up and mobilizing a Living Lab (LL) approach, it is envisioned that this participatory approach would emerge community-based knowledge and capacity building on AE in the Mediterranean. In its Work Package (WP) number 6, the NATAE project aims (i) to identify and specify policy options for fostering AE transitions in a representative set of LLs in line with European strategies with Africa, through dedicated policy research, (ii) to advocate for science-based locally tailored policy changes on the basis of those findings.

In order to respond to those objectives, the first task of the WP6 draws an analytical review of public policies in North African countries including agricultural, environmental, trade, finance, health and nutrition policies. This review focused on analysing the extent to which the constituents of those policies, including focus on water as a major common issue, include factors that are favourable or unfavourable for the adoption of AE. The task mainly looks at how policies could foster or hinder AE transition, identifying gaps, conflicts and inconsistencies in existing sectoral and inter-sectoral policies at multiple levels; mainly national. In addition, to these objectives, the task leader the CIHEAM IAMM, has also extended its research to the international scale in order to provide further insight and enrich that review.

This deliverable is the result of collective work within the T6.1 task: the teams of CIHEAM-IAMM, CREAD, GRDR, IAV Hassan II, INAT, IUCN directly contributed to it, in addition to the support provided by the other partners in North Africa. Their national country reports aim at the analysis of public policies and their synergies and contradictions from the point of view of agroecology. The development and implementation of the national work, the basis of this work, gave rise to several follow-up and sharing meetings within the task (detailed in the methodology section). The resulting country reports helped to document the transversal analysis and synthesis. Data on environmental and agricultural strategies detailed in the national reports were cross-referenced for the synthesis exercise, as well as supplemented by international analysis and a short internal survey of other relevant national policies.

Regarding the problem statement, the purpose of transversal analysis was to formulated main shared strengths and weaknesses of the agricultural sector in the region and to give an assessment of the current abilities and prospects for an agroecological transition, putting emphasis on human, mainly the socio-economic and institutional dimensions, as well as natural and climatic constraints in order to identify the potential drivers and obstacles for such a transition.

Regarding the approach, as a first step, methodological guidelines were shared and finalized with the members of the collective involved.

Among the stages of the overall progression,

1 - The review of the initial methodology and the addition of a short perception survey for resource actors.

These analysis framework and short interview guide for stakeholders, including producers, researchers, associations and administrations in charge of public policies, puts into perspective the analysis of public policy documents from the point of view of their synergies and contradictions and highlights certain characteristics of agroecology and these practices in North African countries.

2 - The characterization of national contexts and an initial collection and inventory of public policy documents. The observation of a common collection of policy strategies linked to sustainability, especially environmental and agricultural.

3 - Analysis of these public policy documents.

4 - At the same time, an investigation of the relevant international strategies for agroecology, particularly in terms of international environment and health took place. A short follow-up survey of country experts for country managers on other relevant policies, such as food security and health policies and their salient features (characteristics) was also mobilized.

The deliverable presents first the transversal synthesis followed by one national report per country. The first synthesis chapter is therefore based on the work carried out by the partners of the countries concerned, and the country reports form the following chapters. The synthesis as well as the country reports have been drafted according to the same overall structure. In the first part, the context data are presented: the agricultural and rural contexts of the countries, from social, economic and environmental points of view, in order to highlight common and differentiated realities, as well as opportunities and constraints. For the figures and regional context tables, it was necessary to rely on data from international organizations, in particular to harmonize and supplement the data available in the reports. This synthesis occasionally incorporates direct elements from the national reports. The analysis of cross-cutting public policies consisted of exploring the characteristics of the strategies presented in the national reports in order to analyse them. Short syntheses are provided throughout the text.

1.2. Detailed methodology

In order to best respond to the objectives of the task, the team has put in place a methodology that mobilizes the participating project partners in each country. First, one representative for each country was nominated by the participants to lead and coordinate the research at country level. Accordingly, one representative was selected for each of Tunisia, Algeria, Morocco, Mauritania and Egypt. Second, and in order to standardize the research and analysis of public policies in each country, the task team put in place an analysis grid. This analysis grid was divided in two main sections:

- **Analysis framework of strategies**

The proposed analysis grid was based on a combination of the main public policy analysis approaches (analysis of actors, institutions, public choices, etc.). It consisted a starting point for producing an initial analysis nourished and supplemented by exchanges and debates with partners through the organization of several workshops.

The main elements of analysis consisted of:

- Elements of context,
- Inventory of existing strategies and documents,
- An analysis framework for each strategy (5 strategies were selected by country in order to meet with the project Key Performance Indicator) including components covering orientation and objectives of strategies, position of agroecology, actors involved, implementation, means and resources put in place, obstacles and contradictions that could impede the adoption of agroecological practices, etc., and
- Skills and information infrastructure in terms of research, academia, extension, and other resources.

A copy of the analysis grid can be found in Appendix 1.

- **Interview guide around the perception of agroecology by various stakeholders**

The interview guide consisted of questioning representatives of different categories of actors on their perception of agroecology and this around the following axes:

- Knowledge of the subject
- And if so; what does agroecology mean to them
- How is it envisaged? a constraint? a necessity?
- If it is a necessity, why? and if it is a constraint why?
- What are the risks and benefits of practicing agroecology?
- What are the needs for adopting agroecology?

The actors that were recommended to be interviewed included: farmers (different types of farmers), researchers, representatives of collective structures (cooperatives, chamber of agriculture), extension workers, representatives of public institutions (ministries and others, etc.), NGOs.

The interview guide was provided with a recorded video support for its explanation; available at:

https://cloud.natae-agroecology.eu/index.php/s/bfFrXJDPqRjmZAa

A copy of the stakeholder interview guide can be found in Appendix 2.

- **Series of internal workshops and discussions**

Based on the findings generated from the above analysis framework, a series of internal workshops and discussion sessions were planned and took place mainly with the country representatives and with the participation of relevant partners when possible. During these workshops, each country representative was given the space to present and discuss their main findings. These workshops allowed to convey feedback and

recommendations of subsequent steps for the country representatives to continue their analysis and to produce the final report per country.

Three main workshops took place on: 1) 26 September 2023, 2) 18 December 2023, and 3) 8 February 2024 (for Tunisia, Morocco, and Egypt) and 26 February 2024 (for Algeria and Mauritania).

- **Formulation of country reports and the transversal synthesis report**

A template for the standardization of analysis reports per country was produced and followed by the country representatives according to the feedback and recommendation during the workshops. These reports were then used as input to produce the transversal analysis report herein. The transversal report synthesises the main ideas and conclusions observed in each country. It also attempts to study and present common issues being faced in countries in North Africa and to highlight what is specific for one or more countries.

A copy of the country report template can be found in Appendix 3.

- **Task timeline**

Stage	Date
1) Methodology & analysis grid distribution	July-August 2023
2) 1st Workshop	September 2023
3) Submission of the first written versions by the partners before the second workshop	Mid-end November 2023
4) 2nd Workshop	Mid-December 2023
5) Second written contribution from the partner before the third workshop	January 2024
6) 3rd Workshop	February 2024
7) Submission of updated written drafts for final review and comments	End of February 2024
8) Final Corrections and Submission of Finalized Revised Versions	Early March 2024
9) Compilation of transversal analysis by the task team	April - May 2024
10) Submission of the final deliverable	End of May 2024

Chapter Two Contextual Background: Agriculture as a Social and Sustainability Issue

2.1. The Macroeconomic and Social Context

All economies have been resilient to the health crisis of 2020-2021, which has significantly affected the economic growth of the 5 countries: Algeria, Egypt, Morocco, Mauritania and Tunisia. As of 2022, a recovery in economic growth is recorded in the region.

2.1.1. Evolution of the main economic indicators

Economic growth, which fluctuated around a rate of 2% in 2020, resumed more modestly in 2022, but more sustained in 2023 for Morocco (3.1%), Algeria (4.2% in Algeria) and Mauritania (4.3%). However, it was more modest (2.3%) in Tunisia plagued by budgetary difficulties (increase in costly energy subsidies, trade deficit, public debt). After increasing in the early 2020s, Egypt's economic growth, the most dynamic, fell from 6.6% in 2022 to 4.2% in 2023 and continues to decline. The inclusion of the informal sector, which would account for between 30 and 60 per cent of total employment, would increase GDP by at least 40 per cent.

These growth rates were mainly driven by exports of energy products (to Algeria), mining and quarrying (to Mauritania), the automotive industry, tourism, remittances from Moroccan residents abroad and agriculture to Morocco, or an increase in remittances from tourism, Tunisians living abroad and agriculture in Tunisia. For Egypt, growth rates are driven by increased remittances from the diaspora, tourism and fees for the use of the Suez Canal.

Inflationary pressures are recorded in all 5 countries. These are the result of higher prices on domestic markets for locally produced and/or imported agricultural and food products. The inflation rate, which reached 13.9% in Egypt for the year 2022 and rose to 23.5% for 2023, has led the country to devalue its currency several times since 2020. The inflation rate recorded in 2023 in Algeria is 9.7% (including 14.0% for food products), its highest level in 26 years. It is more than 8% in Mauritania, nearly 10% in Tunisia, its highest rate in more than three decades, and 6.3% in Morocco, mainly due to food and energy prices. According to the 2021 Human Development Report, Mauritania, with a Human Development Index (HDI) of 0.556, ranks 158th out of 185 countries.

Trade balances are in deficit in the four countries of Morocco ($28.3 billion), Mauritania (nearly $1.5 billion), Tunisia (nearly $5.5 billion) and Egypt ($43.4 billion in 2021/2022). The high prices of energy products exported by Algeria in 2022-2023 have allowed surpluses in the trade balance (more than $10 billion) to return, which had been in deficit since the fall in hydrocarbon prices in 2014.

In Egypt, the rise in world food and fuel prices and the decline in foreign exchange inflows, particularly from exports, tourism and foreign direct investment, which were only partially offset by the increase in remittances from abroad, led to a widening of the balance of payments deficit. The rise in prices on world markets for imported products, and first and foremost cereals (wheat), of which Egypt is the world's largest importer, weighs

on Egypt's trade deficit of USD 43.4 billion, or 9.1% of GDP in 2021/22, despite a recovery in exports in the same year (a total export value of USD 43.9 billion, an increase of 53.1% in one year). This difficult macroeconomic environment has had a negative impact on households. Egypt is highly exposed to risks and price fluctuations in global food markets, caused by factors such as food crises, such as the one in 2008, disruptions in supply chains, as in the case of the Covid-19 pandemic, wars and climate change.

In terms of the major macro-financial aggregates, it is worth mentioning the recovery of foreign exchange reserves in the three countries, Algeria, Morocco and Tunisia. The Monitoring Report on the Economic Situation of Algeria published in the fall of 2023 by the World Bank, notes that the current account surplus allowed Algeria to continue accumulating foreign exchange reserves, reaching US$68.8 billion, or 17.2 months of imports, in June 2023, compared to US$61.7 billion at the end of 2022, or 15.9 months of imports of goods and services. Tunisia's foreign exchange reserves were at the safety threshold, reaching 27,013.6 million Tunisian dinars ($8.7 billion), the equivalent of 120 days of imports. Morocco's official reserves reached $36 billion, fuelled by an active export dynamic.

2.1.2. Some social indicators

Employment is characterised by high levels of informality in all 5 countries.

In Egypt, the total national labour force is around 29.3 million workers, with an unemployment rate of 7.4% in 2021 (CAPMAS, 2021). It was 13.2% in 2013 and has been declining continuously for the past 10 years. In 2021, unemployment affected 5.6% of the male labour force and 15.9% of the female labour force. The share of young people who are not in employment, education or training concerns 16.7% of young men and 42.2% of young women between 15 and 24 years old in 2021. This overall youth unemployment rate was 30% in 2017 (Egypt national report).

In Mauritania, more than 60% of working-age Mauritanians are under the age of 35 with a high risk of becoming unemployed. The level of unemployment seems to be persistent, recording a rate of 12.2% in 2019 (ANSADE) compared to 11.8% in 2017 (Common Country Assessment 2020). Unemployment in 2019 affected women more than men, with rates of 17.3% and 9.3% respectively. More than 60% of Mauritanians of working age are under the age of 35 with a high risk of becoming unemployed.

In Algeria, the unemployment rate had reached 12.3% of the working population (WB, 2023), and more than 1.9 million citizens had benefited from unemployment benefits last October (Ministry of Labour). *In Tunisia*, affecting more than 15% of the working population, it remains significantly higher for women (21.1%) than for men (13.2%). *In Morocco*, the High Commission for Planning reports that the unemployment rate has risen from 11.8% in 2022 to 13% nationally, from 15.8% to 16.8% in urban areas and from 5.2% to 6.3% in rural areas. It remains higher among young people aged 15 to 24 (35.8%), graduates (19.7%) and women (18.3%).

2.1.3. Population, growth and demographic transition

In a century, the population of the 5 countries has multiplied by 4.7 in 70 years. Over the period 1950-2020, the Mauritanian population has increased by 7.5 times and the Algerian population by 4.7 times, as shown in the following table[1].

Table 1: Population trends by country (1950-2020). In 10^6 inhabitants

	1950	1960	2000	2020
Algeria	9,1	11,3	30,7	43,4
Egypt	21,2	27	71,4	107,5
Mauritania	0,6	0,8	2,7	4,5
Morocco	8,9	11,7	28,5	36,7
Tunisia	3,6	4,1	9,8	12,1
Total	43,4	54,9	143,1	203,9

Source: Population pyramide.net, National Statistics

Annual population growth rates in 2020 indicated that, with the exception of Mauritania and Egypt, all countries were engaged in a demographic transition. In 2020, the natural population growth rate was 1.9% in Algeria, 1.3% in Morocco, 1.1% in Tunisia, 2.4% in Mauritania and 2.13% in Egypt. Egypt, in particular, faces a considerable challenge over the next three decades, with a population expected to grow to 120 million by 2030 and 171 million by 2050 (Egypt Country Report).

These populations are young; 40.2% of Mauritania's population is under the age of 15, and 60.6% is under the age of 30. 32.7% of Egypt's population is under the age of 15 and 54% is under the age of 30. In Algeria, just over 26% of the population (26.8%) is under 30 years old, 26% in Morocco, and in Tunisia, a country that began its demographic transition earlier, the rate was 23%.

The average number of children per woman in Mauritania is 5.2 and the average household size is 6.2 (6.3 in rural areas). This average number is significantly lower in urban areas than in rural areas (4.1 versus 6.4). Total fertility rates are 5.2 children per woman in Mauritania, 2.9 children in Algeria and Egypt, 2.3 in Morocco and less than 2 children in Tunisia. In several countries, the average household size tends to fall below 4 children.

The most dramatic historical change is urbanization, which even affects a country like Mauritania where the rate of urbanization is constantly increasing. This reached 55.3% of the total population in 2020 compared to 48.3% in 2013 with an acceleration of sedentarization (DFSPH, 2022, in Mauritania country report). In Algeria**,** the historical reversal of the trend took place in the mid-1980s: the urbanization rate is currently 72%, close to that

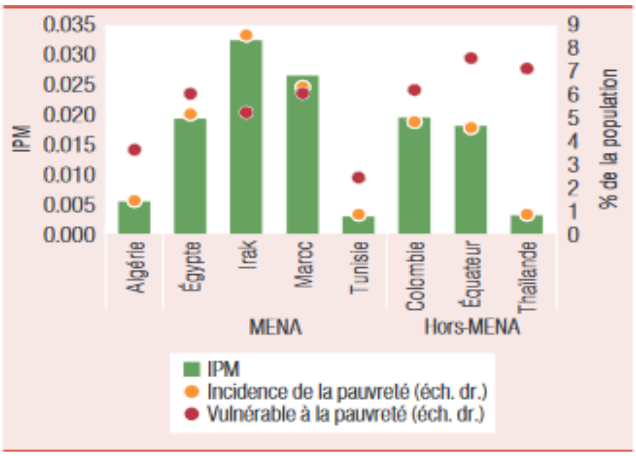
[1] By way of comparison, the Netherlands, which had 11 million inhabitants in 1960, had 17.4 million in 2020, while Algeria rose from 11.3 million to 43.8 million inhabitants in 2020.

of Tunisia (70%). It was during the 2000s that Morocco in turn began a historic turnaround in the distribution of its population, with 65% urban (i.e., 2 out of 3 people) in 2020. It is stable in Egypt with 42.8% urban in 2020.

Demographic changes in the five countries will have a decisive impact on demand for agricultural and food products.

2.1.4. Persistent poverty in rural communities

Multidimensional poverty (MPI)[2] remains relatively high in Mauritania. In 2023, it affects a population of 2.3 million people, or 56.9% of the population. Rural areas are the poor as nearly 8 out of 10 people (77.1%) live in multidimensional poverty. Poverty has a particular impact on women and young people. The MPI in Algeria increased from 2.1% in 2013 to 1.4% between 2013 and 2019. The percentage of people vulnerable to multidimensional poverty also fell from 5.8 per cent to 3.6 per cent. Algeria's multidimensional poverty rate (1.4%) is better than that of its regional neighbours, Egypt (5.2%), Iraq (8.6%) and Morocco (6.1%), but higher than Tunisia's comparatively low poverty rate (0.8%) (WB, 2021).[3]



Source : Estimations du personnel de la BM, sur la base de l'enquête MICS et OPHI.

Figure 1: Multidimensional poverty in the Maghreb (2014–2019) (in French)

Rural municipalities have the lowest enrolment rates for children and the highest rates of adult illiteracy. The Sustainable Development Goals (SDGs) set for 2030 are far from being achieved, especially in Mauritania[4]. The factors of progress have not been continuously disseminated to all rural populations (drinking water and sanitation network).

Poverty still persists in the countryside of the five north-African countries despite efforts to eradicate it. It is an indicator of a crisis in societies and agriculture, which are unable to provide jobs and sufficient income for rural populations.

[2] Multidimensional poverty is an indicator of the World Bank. It takes the measure of the multiple deprivations in terms of education, health, living and employment conditions

[3] Monitoring report on the economic situation in Algeria. Turning the Algerian economy around after the pandemic. Fall 2021

[4] In 2000, Mauritania drew up a *Poverty Reduction Strategy Paper* (PRSP) for the period 2001-2015, which was established in 2001 as the Poverty Reduction Orientation Law, making it the reference for medium- and long-term economic and social development. In 2010, a new review was initiated with the aim of drawing up a third action plan covering the period 2011-2015. This revision is based on the assessment, the diagnosis, the lessons learned from the implementation of the CSPL II as well as the outlook for the period 2011-2015.

Box 1. Poverty and food insecurity in Egypt

Poverty has led to an increase in household food insecurity. CAPMAS estimates from the 2010-2011 Survey of Household Income, Expenditure and Consumption (Egypt, CAPMAS 2011) show that income poverty increased from 19.6% in 2004-2005 to 21.6% in 2008-2009, to 25.2% (21 million people) in 2010-2011 and to 27% (24 million people) in 2015. Between 2009 and 2011, 15.2 per cent of the population (12.2 million people) fell into poverty, double the percentage of those who were lifted out of poverty (7.7 per cent), and 12.6 per cent of the population remained in chronic poverty.

Over the past decade, Egypt's poverty rate has been steadily rising. As of mid-2016, Egypt's poverty rate was 27.8%, an increase of 2.6% from 2010.This high poverty rate in Egypt has affected children, many of whom are malnourished. In mid-2014, 31% of children under the age of 5 were stunted due to malnutrition. Often, families with little money choose to spend it on cheaper food rather than nutritious food. Poverty in Egypt affects not only many children, but also people living in rural areas. In July 2016, the poverty rate in rural areas was 37% higher than in urban areas. In 2019, 32.5% of the population lived below the national poverty line, up from 27.8% in 2015. The extreme poverty rate is estimated at 6.2 per cent (CAPMAS). Rising poverty has led to an increased reliance on cheaper, high-calorie foods, including subsidized staples, all of which are linked to obesity. Due to high food prices, changing lifestyles, and lack of nutrition awareness, obesity is on the rise in Egypt, where an estimated 48% of women over the age of 15 are obese. The coexistence of obesity and stunting has exacerbated the double burden of malnutrition in Egypt, which is now one of the highest in the world.

According to a recent study conducted by IFPRI (2022) among 6000 poor and borderline households, 47% of households surveyed were forced to reduce their diet and 70% opted for products that were both cheaper and less nutritious, thereby increasing the double risk of malnutrition and obesity.

Source: Egypt Country Report

2.1.5. Increased health and nutritional diseases

The demand for agricultural and food products in the region has been steadily increasing, due to demographic growth. According to Marty *et al.* (2015), "these needs have increased fivefold in the space of fifty years".

This increase in demand was mainly for cereal products, vegetable oils, sugar plants and livestock feed, particularly oilcake.

Resulting changes in diet, mainly the prevalence of fats and sugar have leads to new health problems, mainly an increase of diabetes and obesity in all countries even if more marginally in Mauritania (below table). These problems are compounded by food price inflation since COVID as the majority of the population favour systematically cheapest products to ensure enough access to food.

Table 2: Prevalence of obesity among adults in the 5 countries (2016) – In %

Country	Prevalence of obesity (%)
Mauritania	12,7
Morocco	26,1
Algeria	27,4
Tunisia	26,9
Egypt	32

World: 16% in 2022

Source: FAO, Statistical world book, 2022

2.2. The Place of Agriculture in Countries' Economies

The Maghreb countries and Egypt have not ensured a structural transition of their economies[5], which explains the preponderant place of agriculture in their economies.

The relative share of agricultural GDP in national economies is, on average, 3 to 8 times higher depending on the country considered than in the countries of the European Union[6] (1.6% of GDP on average) or Romania (4.3% of GDP) as shown in the following table.

Table 3: Share of agriculture in countries' economies (2022)[7] . In percentage

Country	Economic Indicators				
	GDPA (%)	**Employment (%)**	**% of exports**	**% of imports**	**Government expenditure: %**
Algeria	14,0	19,3	2,0	23,3	2,9**
Egypt	10,7*	19,8	16,7% * 20% with processed products	7,8***	1,3**
Mauritania	14,9	29,5	24,2	26,1	-

[5] This is a reference to Rostow's canonical model, which notes a transition from the primary sector (agriculture) to the industrial sector and then to the tertiary sector during the historical cycles experienced by the so-called developed countries.
[6] In 2023, the agricultural sector generated 2.1% of French gross domestic product (GDP) in France. While this share has fluctuated between 1.5% and 2.3% since 2000, it has been steadily declining since the 1950s. In 1949 – the first year in which statistics produced by the National Institute of Statistics and Economic Studies (INSEE) are available – agriculture, forestry and fisheries generated value added equivalent to 18.1% of GDP. This share then declined steadily, from 12% in 1960 to 7.5% in 1970 and 4% in 1980.
[7] As far as possible, we have used the data provided by the national reports. However, we used the FAO Statistical World Book (2022) to harmonize the data and make them comparable, as the national reports did not always have the same reference years.

Morocco	9,8**	34,6	15,0	13,1	3,5**
Tunisia	10,1	13,9	12,0	9,7	2,2

*Source: FAO, Statistical world book, 2022. National reports. *:2021; **: 2021; ***: 2017.* Agricultural exports are as a percentage of total exports.

The share of employment remains relatively high (from +10% to more than 34% depending on the country) and agricultural trade, particularly the share of imports, is significant in the majority of countries. Paradoxically, public spending is more than modest, with no one spending more than 5% on agriculture[8].

The Agricultural Gross Domestic Product (GDPA) accounts for nearly 15% of wealth creation in *Mauritania*. It also contributes 29.5% of employment, and provides income to nearly 54.98% of the population (Source: PA2 SCAPP). The economic role of the livestock sector in the agricultural sector should be highlighted. Although nomadism is declining, especially in the south of the country (5% today compared to 60% in the 1960s), livestock farming remains one of the main pillars of Mauritania's rural economy. Its contribution to the national economy was, on average, 10.9% of GDP over the period 2016-2020 (Source: PA2-SCAPP). It is the second largest employment sector as it employs nearly 16% of the active population, and provides income to nearly 60% of the population (source: PNDE 2018). Women hold more than one-fifth of agricultural jobs (21.4%) according to the latest FAO data (FAO, 2022).

In Egypt, the agricultural sector employs 5.2 million workers who represent nearly 20% of the country's workforce. Agriculture (PIBA) contributes nearly 11% of GDP. In 2021, exports of agricultural products amounted to $7.3 billion and accounted for about 16.7% of national exports. Family farming concerns more than 24 million people, i.e., 57% of the rural population. It should be noted that the available agricultural area represents 4% of the total surface area and agriculture is almost entirely irrigated, either by the waters of the Nile and its tributaries (the old lands) or by the use of underground aquifers (the new lands).

In Morocco, agricultural GDP stood at 130 billion dirhams in 2022 (more than $12.7 billion), or nearly 10.8% of the total PV, and 9.8% of GDP (with territorial adjustment). It varies globally between 10% and 18% depending on whether the years are dry, normal or rainy. The evolution of agricultural GDP recorded in 2022 reflects a decrease of -12.9% (at the price of the previous year) compared to 2021, mainly due to climatic conditions. It had varied in previous years between 10% and 18% depending on whether the years were dry, normal or rainy. It has been observed that in a dry year, agricultural GDP has a negative impact on overall GDP growth, even though the volatility of agricultural growth has reduced over time[9].

However, the share of agriculture in employment remains high, with more than a third of the working male population (34.6%) employed in the sector. In the agricultural sector, =more than a third of jobs (34.6%) are held by women. The structure of employment in rural areas also remains largely dominated by the "*agriculture,*

[8] Meeting in Maputo, Mozambique in 2003 and Malabo, Equatorial Guinea in 2014, African Union member states pledged to devote 10% of their national budgets to food and agriculture, with the aim of fuelling social and economic growth.
[9] Volatility per decade, which went from a ratio of 1 to 7 (during the decades 1990-2000) to a ratio of 1 to 3 for the decade 2009-2020. The decrease in volatility is the result of recent agricultural strategies, which have made it possible to mobilize irrigation water and encourage crop conversions. The "cereals" sector, which accounted for 15.8% of agricultural value added in 2014, saw its share fall to 6.3% in 2020.

forestry and fisheries" branch with 62% of rural employment, followed by "*services*" with 17.9% and "*industry* " with 14.1% (Morocco country report).

In Algeria, the agricultural sector represents more than 14% of GDP in 2023, with an added value of 2546.9 billion Algerian dinars according to the National Statistics Office (ONS), or nearly 18.9 billion dollars. This contribution has changed from year to year depending on climatic conditions and the influence of several macroeconomic factors, such as public policies and agricultural programmes implemented, investments in the agricultural sector, fluctuations in the prices of agricultural products on world markets, as well as other factors related to domestic demand and agrarian structures. The 2.6 million strong agricultural labour force still accounts for almost 20% of the total labour force (19.3%). Female employment has tended to increase on farms in recent years. In 2020, it accounted for 6.5% of total agricultural employment (FAO, 2022).

In Tunisia, agriculture contributes 10.1% to the national GDP. It employs 15% of the working population and provides a fixed income to nearly 470,000 farmers (Mahjoub and Belghith, 2022). Family farming, made up of a large number of smallholders, dominates the agricultural social landscape. Finally, it should be noted that about 34% of the Tunisian population lives in rural areas and depends on the agricultural sector for its direct income (Tunisia country report).

2.3. A Deficit in Trade Balances and a Dependence on Cereals

In all five countries, demand for food and agricultural goods is, on average, the largest component of household budget expenditure.

In Mauritania, two-thirds of food expenditure (and more than 75% in rural areas) is spent on food (Mauritania Food Security Survey, 2009). Food is the main item of expenditure for Egyptian households: 37% of Egyptians' consumption expenditure in 2017-2018 compared to 34% in 2015 (CAPMAS, 2021). According to the report, food continues to be the largest part of the budget for both rural and urban households. 40.2 per cent of monthly expenditure in rural areas is spent on food, compared to 33.9 per cent in urban areas. If we consider the situation of the most vulnerable Egyptian households (IFPRI, 2022), more than half of their income is spent on food, a percentage that is increasing and poses a major threat to the stability and development of the country, especially in rural areas where 67% of Egyptians considered poor live.

In Tunisia, the share of household budgets devoted to food is was 30.1% in 2021 (National Survey on the Budget, Consumption and Standard of Living of Households 2021). In Morocco it is 37% (38.6% in rural areas (Morocco National Survey on Household Consumption and Expenditure 2013/2014), and in Algeria, it is more than 40% (45.9% in rural areas) (Survey on Consumption Expenditure and the Level of Consumption and Income). Household Life 2011).

As domestic supply is insufficient, all countries resort to imports to meet needs. Exports, which are significant in Morocco, Egypt and Tunisia, are not able to cover imports, resulting in a deficit in agricultural trade balances in the five countries, as shown in the following table.

Table 4: Trade in agricultural products by country (2020)*. In 106 USD$

	Exports	Imports	Trade Balance
Algeria	501	8494	- 7993
Egypt	4592	13061	- 8469
Mauritania	629	806	- 177
Morocco	5977	5684	+ 293
Tunisia	1454	2055	- 601

*Source: FAO. Statistical World book. 2022. * Excluding fishery products*

In Morocco, exports of fishery products exceptionally enabled the country to generate a positive trade balance (around $293 million) in 2020. With exports of fishery products, which account for more than 90% of agricultural exports and 24.2% of total exports, the deficit has been reduced in Mauritania to minus $177 million. Tunisia's agricultural trade deficit is down to minus $601 million. While fishery products enable Morocco, Tunisia and Mauritania to improve the coverage of imports by exports, the deficits are very clear for cereals (below Table).

Table 5: Imports of cereals in 2020 (in 10^3 tons)

Country	Maize	Wheat	Rice	Other
Algeria	5 010,4	7 053,6	140,4	866,8
Egypt	7 880	9 042	75	7,7
Mauritania	12,8	685,6	48,7	-
Morocco	2 866,7	5 521,5	65,6	1 153,4
Tunisia	1 004,5	1 995,3	25,9	973,2
Total	7 774,4	24 298,0	355,6	3 001,1

Source: FAO. Statistical World book. 2022

Dependence on cereals is high in the five countries that are net importers of wheat, maize and barley. On average, Egypt imports about 60% of its food needs, to varying degrees depending on the food commodity (Egypt country report). All basic food commodities are imported and highly dependent on international markets, but with varying rates of dependence on imports. The most important food items in the traditional Egyptian diet are wheat, corn, edible oils, sugar, and beans. These products are heavily imported to bridge the gap between consumption and production. In general, consumption exceeds production for all commodities except fruits and

vegetables, which means that Egypt is completely self-sufficient only in fruits and vegetables. Horticultural crops are all, with a few exceptions, exportable crops, and almost all agricultural exports are horticultural crops. These are mainly citrus fruits, potatoes, onions, table grapes, tomatoes, green beans, strawberries, artichokes, green peppers and mangoes.

In Mauritania, national food systems are heavily dependent on food imports, particularly cereals, which accounted for USD 218.4 million in 2018. Moreover, since 2000, cereal imports have accounted for between 29 and 50 per cent of total food imports, which have quadrupled over the same period, indicating the country's high dependence on imports. For cereal products, the dependency level reached 64% in 2019.

In Algeria, there is a structural deficit in so-called basic products. On average per year over the period 2010-2019, national production has only slightly covered the needs of the population: 10% for soft wheat and 50% for durum wheat, almost all for oils and sugar and 58% for milk.

As the increase in food demand could not be met by local supply, imports were crucial to meeting the country's food needs. The food bill has been growing continuously in recent decades, and Algeria is now Africa's largest importer of foodstuffs, with nearly 75% of its basic food needs met by imports (below Table).

Table 6: Algeria's food bill (2000-2020)

Years	2000-2005	2006-2010	2011-2015	2016-2020
USD Billion	1,7	4,2	9,5	8,4

Source: Customs. Algeria's Foreign Trade Reports

In Algeria, in value terms, food imports rose from an average of $1 billion in the 1970s to $2 billion in the 1980s, $3 billion in 2003, averaged around $4.2 billion annually in the years 2006-2010, and then doubled in the years 2011-2015 under the combined effect of the rise in world prices and import volumes. They have stabilised at around $8.5 billion on average per year, the decline in the food bill over the latter period having been the result of a drop in world prices rather than a drop in imported quantities (with the exception of cereals in 2020, which was marked by record cereal production in 2019). The only significant exports in recent years are dates and especially refined sugar[10], for an amount of $73 million and $303 million respectively in 2020. These food imports represent between 17.40% in 2013, and 23.52% (in 2020) of total imports. Throughout the period 2015-2020, the share of food imports averaged almost one-fifth (19.21%) of total imports per year. These imports are the cause of a structural deficit in the structural agricultural trade balance, with exports covering just over 5% of the amount of food imports for the year 2020**.** The persistent choice of public authorities to keep food prices low has led to a disparity that has been stimulated by population growth and food purchasing power supported by subsidies. Food demand has continued to grow, while the average daily food intake per capita has increased significantly, from 1577 kilocalories in the early 1960s to 3479 in 2022.

[10] The private company CEVITAL imports raw sugar, which it refines in its factories and exports to Africa or Europe. The competitiveness of Algerian sugar is the result of the use of cheap energy because it is subsidized. The latter accounts for more than 30% of the refining costs.

Tunisia is an exporter and importer of agri-food products. However, the agricultural trade balance has rarely been positive and the country is dependent on world markets for commodities such as cereals, sugar or vegetable oils. At the end of October 2023, the coverage rate was 85.7%, which represents an annual deficit of 912.12 MD (nearly $295 million). These figures show an improvement compared to the year 2022 when the deficit was 2046.3 MD ($664 million) and the coverage rate was 69.1% (ONAGRI, 2023). This improvement is due to a 20.4% increase in the value of exports, particularly of olive oil (54.3%) and a 3% decrease in the value of imports, mainly cereals (-9%) and vegetable oils (-26.7%). More than half of Tunisia's imports by value are cereals, including wheat, barley and maize. Tunisia also imports vegetable oils, sugar, milk and meat derivatives (below Figure).

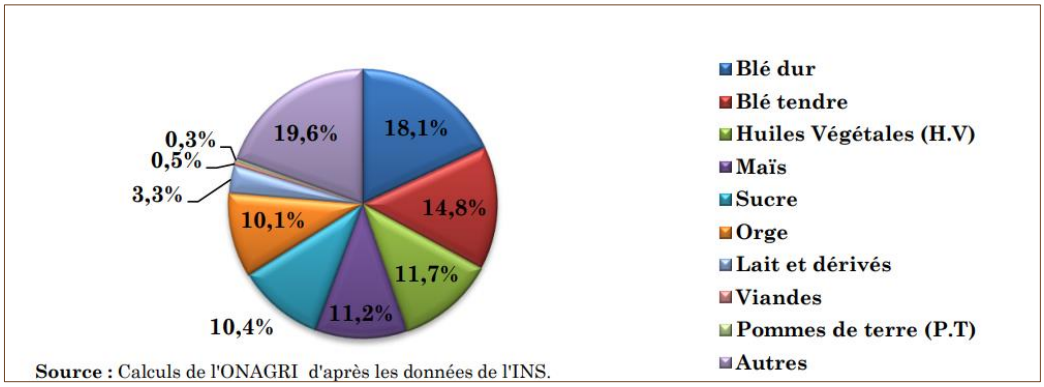


Figure 2: Value shares of the main imported products in food imports at the end of October 2023 (ONAGRI, 2023) (in French). *Source Tunisia national report*

More than half of Tunisia's imports by value are cereals, including wheat, barley and maize. Tunisia also imports vegetable oils, sugar, milk and meat derivatives. Cereal imports totalled 3.4 million tonnes in the 2021-2022 season. Tunisia imported 3.2 million tonnes in 2023 (809,400 t of durum wheat, 945,700 t of soft wheat, 693,200 t of barley and 801,600 t of maize) and the forecast for the 2023-2024 season is 4.7 million tonnes. In 2023, cereals accounted for more than half of food imports, and the cereal dependency rate is over 60% in 2023 (ONAGRI, 2023). Olive oil occupies the largest share of food exports by value (51.4%). Tunisia also exports dates, fishery products, other oils and derivatives, as well as a variety of other products (below Figure).

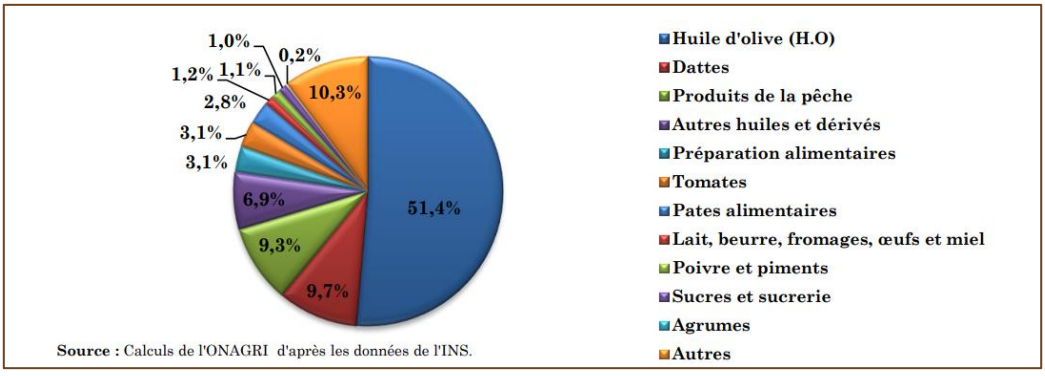


Figure 3: Value share of the main exported products in food exports at the end of October 2023 (ONAGRI, 2023) (in French).

Source: Tunisia national report

The Ukrainian conflict has led to a rise in wheat prices: the price of wheat reached €422 per tonne on Euronext on 8 March 2022, i.e., two and a half times the price of 2020, before falling relatively since then. About 60% of the wheat consumed in Tunisia came from Ukraine and Russia. This has had a direct and substantial impact on food security in the country. In addition, there have been disruptions in transport and logistics operations and the explosion in input prices, especially those of nitrogen fertilizers, whose prices have tripled since January 2022 (FTDES, 2022).

In Morocco, the dynamism of the agricultural exports sector has enabled the country to position itself as one of the world's leading exporters of agricultural products. In particular, it is the world's leading exporter of capers and argan oil, the world's 3rd largest exporter of canned olives and small citrus fruits, and the world's 4th largest exporter of tomatoes. Compared to the European Union market, Morocco is positioned as the leading extra-EU supplier of tomatoes and canned olives, the 2nd largest extra-EU supplier of olive oil and the 3rd largest extra-EU supplier of citrus fruits. The share of agriculture in the country's total exports increased from 7.47% in 2015 to 12.5% in 2020, and 13.1% in 2022. The majority composition of Moroccan agricultural exports is as follows: it is dominated by tomatoes, followed by citrus fruits and fruit and vegetable products. Most of the exports go to the European Union (below Figure).

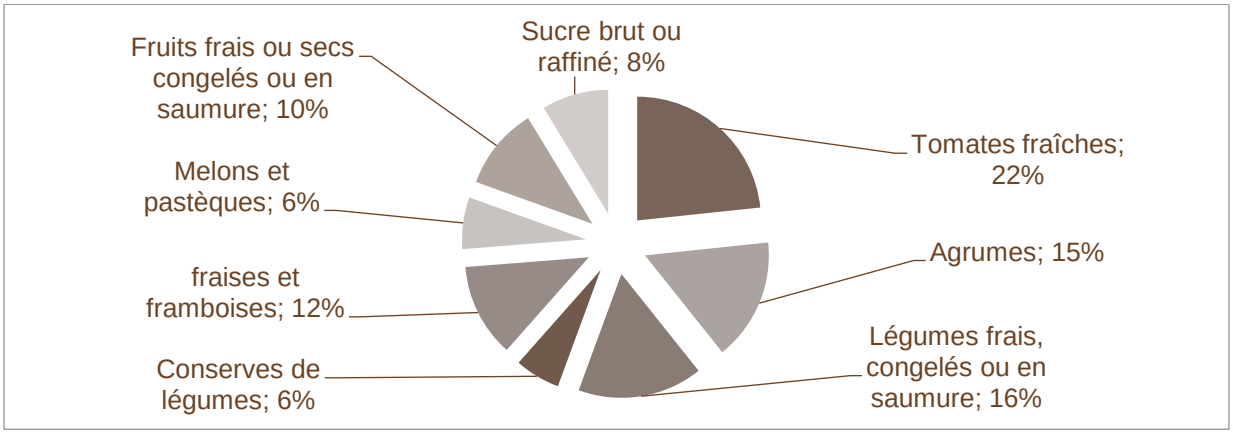


Figure 4: Breakdown of Morocco's agricultural exports by value by main products (%) (in French).

Source: Morocco national report

The coverage rate of food imports by exports reached 118% in 2019, before declining to 102% in 2020 (Morocco national report). Dependence on cereals, which was close to 50% a few years ago, has increased due to the poor harvest in recent years. Morocco imported nearly 8 million tonnes of cereals in 2021-2022, just over 6 million tonnes in the 2022-2023 marketing year, and expected imports in 2024 amount to more than 7 million tonnes. These massive imports will contribute to a deficit in the agricultural trade balance.

Egypt's agricultural production covers only 40 per cent of the country's food needs, with the remaining 60 per cent imported from the international market. This 60% food deficit is widening over time (country report, Egypt) as demand for food increases due to a combination of population growth and improved living standards. Egypt is currently the world's largest importer of grain. Historically, the main challenge facing Egyptian agriculture, especially over the past three decades, has been to produce more food in order to meet the growing demand for food due to the growing population and to accelerate the agricultural exports needed to earn foreign

exchange. It should be noted, however, that the objective of food security has been given an increasingly high priority (Egypt country report).

2.4. Recent Trends in Organic Agriculture

Organic agriculture is developed mostly in Egypt, Tunisia and to a lesser extent, in Morocco. Algeria and Mauritania are planning to develop organic agriculture as well. The dynamics observed shows that this sector has not been impacted by the COVID period nor by recent inflation trend.

Organic agriculture in Egypt occupies 116000 ha representing about 2.9% of the total cultivated land in 2021, and approximately 970 farms, with a concentration in the Governorate of Fayoum, 100 Km south of Cairo. In Tunisia, the organic farming sector concerns 3,1% of cultivated surfaces and more than 260,000 ha of areas set aside for crop production are certified organic (ONAGRI, 2018). This area doubled between 2010 and 2018. The number of producers active in this sector also exploded between 2016 and 2018, rising from 3,467 to 7,970 (ONAGRI, 2018, in Tunisia country report). For Morocco, in addition to spontaneous harvesting, 12,000 hectares of cultivated land are set aside for organic farming, with a total production of around 120,000 tonnes. Almost 80% of the cultivated area is divided between 5 main production regions: Fès-Meknès, Marrakech-Safi, Souss-Massa, Casablanca-Settat and Rabat-Salé-Kenitra. For spontaneous harvesting, the main species concerned are argan, PAM, carob, prickly pear and caper. Between 2010 and 2019, the area under cultivation and overall production tripled (Morocco country report).

In Egypt, the range of certified organic products currently produced include vegetables, (31%) medicinal an aromatic plant (27%), field crops (18%), fruits (15%), fodder (5%), oil crops (4%), fiber crops, and sugar.

Most certified organic production in Egypt is geared towards export markets, and up to half of Egypt's organic produce (40-50%) is exported to EU and USA. The remainder (50-60%) is sold to high income consumers at the domestic market. Further, the organic products find increasing share in the local market as well as exports to the EU and other markets. In Tunisia, organic farming has contributed almost 20% of Tunisia's total agricultural exports to the food trade balance in 2021 (United Nations Tunisia, 2022). Most of this area is reserved for olive growing. In fact, Tunisia is ranked first in the world in terms of areas devoted to organic olive growing. The rest of the area is given over to other crops such as fruit trees, date palms, cacti (prickly pear and Aloe vera), cereals.

Organic farming sector has been recently organised by national legislations in Egypt (2020), Tunisia (2021) and Morocco (2019), involving local private entities affiliated to IFOAM and foreign certification bodies (Egypt), both public or private bodies approved by the Ministry of Agriculture (Tunisia), accredited Control and Certification Bodies (OCC) such as CCPB and ECOCERT Morocco (Egyp, Tunisia and Morocco country reports).

2.5. Synthesis

The countries of the North African region share common problems in terms of their food constraints and the economic situation of the agricultural sector. Agriculture is a key sector for all countries in the region due to its large active population and the large number of farms. Across the region, agriculture remains the keystone of the rural economy and a strategic source of supply for cities.

For several decades, most of these countries have simultaneously aimed at food security objectives as well as export objectives for agriculture on high value-added production (Egypt, Morocco, Tunisia and Algeria), which have led globally to the intensification of production systems through the use of chemical inputs, mechanization and irrigation. These efforts have led to achieving national self-sufficiency in two specific sectors, notably meat and milk in Morocco and Tunisia (more than 95% in 2018 in Tunisia for meat). But in all North African countries, cereal production, as well as olive and sugar production, remains insufficient to satisfy national demand. All North African countries remain very dependent on agricultural imports (especially cereals) and are subject to variations in world food prices, which de facto leads them to strengthen their export policy to offset their trade balance. It is also in this export-oriented context that organic farming is developing, even if national demand is emerging and growing (Egypt, Morocco, Tunisia). Mauritania, whose agricultural sector is dominated by livestock, occupies a specific place, agricultural intensification is less remarkable there and production is insufficient to be exported.

Thus, the agricultural trade balances of all countries remain negative (when the fishing sub-sector is not considered), which also weighs on the sector's room for maneuver.

Agricultural intensification strategies and increasing liberalization of access to land have been imposed on the agricultural sector on the one hand by globalization and its liberal model since the 1980s (price competition, opening of trade, need to export according to its comparative advantages), on the other hand by national governments whose essential concern remains food security, and the payment of the cereal bill. However, neither of these two objectives has been clearly achieved today (self-sufficiency, surplus exports).

Since 2019, access to food has become more difficult everywhere for the most deprived populations, due to inflation linked to the conflict in Ukraine, leading to a deterioration in the quality of their food in a context marked by the resurgence diseases like diabetes and obesity. In this context, it is interesting to note that local agricultural production constitutes a real opportunity in rural areas to organize access to better food for the poorest.

Countries in the region have shown strong economic resilience to the COVID episode. For agriculture, the COVID experience has also marked a renewed interest in the search for alternative and more local food strategies (as in Mauritania), also reinforcing the importance of self-consumption strategies in agricultural households, and their relevance.

2.6. Degradation of Natural Resources in North African Countries

The trend of land and water degradation is agreed upon in all national reports. These reports mention the signs of this degradation of natural heritage (soil, water, forests, biodiversity) in the loss of arable land, soil erosion, salinization and various forms of pollution (nitrates, pesticides, etc.), the advance of desertification, siltation and the decrease in dam reserves, the dieback of certain oases, the overexploitation of groundwater, the decrease in forest biomass in connection with an increase in fires caused by the construction of the soil. by the scorching summer heat, etc.

Droughts in the region over the past five years have led to water shortages and severe shortages that have affected agriculture, but also almost every aspect of economic development and people's lives.

The diagnosis of the state of natural resources is severe: they are scarce and are degrading under the effect of multiple forms of erosion and/or overexploitation that threaten the ecological balance of the various natural regions.

Despite the many actions, institutional reforms and agricultural policies implemented since the 1970s, the States of the region have not been able to reverse this trend of degradation of natural resources which is described and documented in national country reports.

While institutional deficits, financial resources or current management of natural resources are mentioned, the national country reports question the foundations of agricultural growth, which gives priority to increasing agricultural production in order to ensure the imperative of food security.

2.6.1. Low land endowments

The Maghreb and Egypt have a low endowment of agricultural land. In Egypt, the agricultural area represents 4% of the total area. Large areas of these regions are occupied by deserts and steppes. The desert also occupies a large part of Algerian, Egyptian and Mauritanian territory. Rangelands and steppe concentrate more than 30 million ha in Algeria, 39.2 million in Mauritania, 21 million in Morocco and 4.7 million ha in Tunisia (FAO, 2023).[11]

Table 7: Utilised Agricultural Area and Irrigated Land in 2020

Country	Utilised Agricultural Area (ha)	SAU/habit. (ha)	Agricultural assets (103)	UAA/ agricultural assets (ha)	Irrigated land	
					(1000 ha)	% UAA
Algeria	8 590 000	0,19	1 117	7,6	1 365	15,8
Morocco	9 382 000	0,25	3 660	2,5	1 946	20,7
Tunisia	5 250 000	0,43	481	10,9	440	8,3
Mauritania	513 000	0,11	337	1,5	147	28,5
Egypt	3 950 000	0,04	5 200	0,8	3 800	96
TOTAL	27 670 000	0,14	10 795	2,56	7 698	na

National reports. FAO. Statistical World book. 2022

[11] FAO. 2022. World Food and Agriculture – *Statistical Yearbook 2022*. Rome.

The 5 countries combined have only 27.67 million ha for an estimated total population of 203.9 million. According to national statistics, the population in 2023 was 45.6 million in Algeria, 107.5 million in Egypt, 37.8 million in Morocco, 11.8 million in Tunisia and 4.8 million in Mauritania.

The UAA ratio to the number of inhabitants is thus 0.14 ha in 2023. By way of comparison, at the beginning of the 2020s, the ratio of arable land[12] per capita in the Maghreb (Algeria, Morocco, Tunisia) was on average only 0.16 hectares compared to just over 0.20 hectares in the northern Mediterranean countries (RED, 2020).[13] These ratios differ greatly from country to country.

Egypt is the least favoured country, both for the current ha/capita ratio (ratio of 0.04 ha/capita), as well as for the ratio of ha/agricultural worker (0.8 ha/farm worker), followed by Mauritania with a low ha/capita ratio and a low ratio of ha/ha to agricultural worker (ratio of 0.11 ha/capita and 5 ha/agricultural asset). They are also the driest countries in the sample. Egypt, and to a lesser extent Mauritania, are specific cases; For example, in Egypt, it is estimated that the existence of two agricultural seasons (as in the Senegal River region of Mauritania) and the possibility of several harvests on certain plots bring the agricultural area under cultivation to 6.7 million ha each year (Egypt country report).

Tunisia is the most advantaged country, both in terms of the ratio of ha to inhabitant (with 0.43 ha to inhabitant) and in terms of the number of ha per worker (10.9 ha per agricultural worker). The large number of active people employed in agriculture in Morocco explains the low area available per worker (2.5 ha/agricultural worker). Following the loss of arable land, between 1995 and 2015, Algeria had less than 28% UAA per capita, Morocco less than 29% and Tunisia less than 18% (RED, 2020).[14]

Land equipped for irrigation covers a total of 7.7 million ha regionwide, or 27.8% of the total arable land. If we remove Egypt, they concern nearly 4 million ha (3.998 million ha), both the Old and New lands (below table Box) or 16.8% of the total arable land, an area equal to that of Spain (3.8 million ha in 2020).

Table 8: Three main types of land in Egypt

Type of land	Surface	Irrigation source
Rainfed land	0.17 million ha	NA
Old land	2.5 million ha	Nile irrigation
New land	1.3 million ha	Aquifers and Nile irrigation
Total	3,95 million ha	

Source: Egypt country report

[12] The FAO defines arable land as land that can be ploughed and cultivated. Includes field crops, vegetable crops, artificial grassland and fallow land. Permanent crops (arboriculture and permanent grassland) are not included.
[13] UNEP, UNEP/MAP, Plan Bleu. 2020. *Report on the State of Environment and Development in the Mediterranean* in 2020 (RED 2020)
[14] United Nations Environment Programme/Mediterranean Action Plan and Plan Bleu (2020*). State of Environment and Development in the Mediterranean*.

Fallow land occupies a significant share of cultivated land. The cereal-fallow system accounts for 75% of the total arable land area in Algeria and Morocco. In Tunisia, we also have an extensive system: arboriculture (olive growing, phoeniciculture and citrus fruits), whose surface area is increasing year after year, representing 52% of the cultivated area in 2020.

As Mauritania is a predominantly Saharan country, fertile and exploitable land is quite limited. Raw, young, skeletal, poorly differentiated mineral soils developed on ergs and rocks covering about 80% of the country. The country has a significant agricultural land potential of 513,000 ha (0.44% of the total area of the country), divided into four agro-ecological zones: (i) the arid zone (16,000 ha, or 3%), (ii) the Sahelian zone (310,000 ha, or 61%), (iii) the Senegal River Valley zone (175,000 ha, (iv) the maritime zone (12,000 ha, i.e., 2%), which is currently very underexploited and can be developed in the context of food security.

In Mauritania, the five main production systems are dependent on cultivated agro-ecological zones, which are: (i) the extensive rainfed cropping system in sandy or "diéri" areas, (ii) the cropping system behind dams and lowlands, (iii) natural or controlled flood recession systems, (iv) the oasis system and (v) irrigated agriculture with total water control (below Box). The country is characterized by the importance of livestock farming, which stands out for its presence in all regions and for its diversity as well. The pastoral agro-ecological zones in the country are as follows (Mauritania country report):

- The eastern Sahelian zone is the most important breeding area, with a cattle herd constituting 64% of the population, sheep and goats reaching 49% of the population and finally camels 40% of the population;
- The Sahel-West zone is the second largest livestock farming area in the country, accounting for 33% of the cattle herd, 44% of the sheep and goat herd and 22% of the camel herd;
- The arid zone is the least important livestock area, accounting for 3% of the cattle herd, 7% of the sheep and goat herd and 38% of the camel herd.

Box 2: Diversity of agro-ecological zones in Mauritania

Four agro-ecological zones can be characterizing in Mauritania with specific natural and productive potential: (i) the arid zone, (ii) the Sahelian zone, (iii) the Senegal River valley zone and (iv) the maritime zone.

The arid zone, which covers 80% of the territory, includes the wilayas of Tiris Zemour, Adrar, Tagant, and Inchiri and the 3 Moughataa in the north of Assaba and the two Hodhs where the plant population is almost non-existent due to the very high temperatures, the dryness of the air and the very low rainfall. The predominant production system is oasis-type characterized by the cultivation of date palm and associated irrigated crops (cereals, alfalfa, vegetables and fruits). Livestock and rainfed crops occupy secondary places.

The Sahelian zones (East and West) include the 3 wilayas of south-eastern Mauritania, namely Assaba, the two Hodhs (with the exception of the 3 Moughataa included in the arid zone), the Moughataa of the North of Brakna, Gorgol, Trarza and Ould Yengé in Guidimakha. The existence of a summer rainy season, which alternates with a dry winter season, allows the production of rainfed crops. In the eastern part, livestock farming is predominant compared to rainfed crops of traditional cereals (sorghum, millet, maize). However, the western and southern part is characterized by the cultivation of traditional cereals behind dams, dikes

and at the level of the lowlands, particularly in Assaba (in Affolé), in Brakna (Magta Lahjar and Aleg) and in the Moughataa of M'Bout and Monguel in Gorgol. In these areas, livestock farming is of the transhumant type.

The Senegal River Valley area, although it covers only 2% of the total area of the country, is the area that has water resources and vegetation allowing the development of agro-sylvo-pastoral activities. In this area, the predominant production system is agriculture in its various forms, led by the irrigated cropping system, followed by the natural or controlled flood recession system of the walo, and that of rainfed crops. Livestock farming is sedentary, semi-intensive with a short transhumance during the growing season. The area covers the south of the 4 wilayas of the river valley (Trarza, Brakna, Gorgol, Guidimakha) where anthropogenic and animal pressures on resources are increasingly accentuated and generate processes of degradation of the natural environment already subject to the effects of drought.

The maritime zone covers a narrow 50 km wide coastal strip that stretches from Nouadhibou to the mouth of the Senegal River for a total area of 25,000 km². The significant fishing potential of the coastline makes it a highly coveted area for foreign industrial fishermen, while small-scale fishing remains limited and mainly benefits local populations. Nevertheless, there is an opportunity for the development of horticulture in this area, with Nouakchott the capital, as being the main selling place with high demand for these agricultural products. Urban livestock farming is also being developed in peri-urban areas.

In these ecological zones, there are also wetlands that serve as transit areas for migratory birds.

Source: Mauritania Country Report

In addition to these agro-climatic constraints, there are those linked to very unfavourable agrarian structures.

2.6.2. Dualistic agrarian structures

In all countries, an examination of the state of structures reveals a process of concentration of land assets that coexist with fragmentation and/or fragmentation of holdings. Actors outside the agricultural sector are now competing with farmers or herders for access to agricultural land or water.

In Egypt, in the 2009-2010 Egyptian Agricultural Census, the total number of farms was 4.4 million, with an average farm size of 0.92 ha. Holdings of less than 0.42 ha (or less than 1 feddan) account for more than 48% of the total number of holdings and holdings of less than 1.26 ha account for more than 84% of the total number of holdings. From the point of view of land fragmentation and land concentration, a distinction must be made between the space of old land in the Nile Valley and the space of new land based on the exploitation of groundwater resources (Egypt country report). Due to the high population intensity in the old area compared to the new one, the average farm size is smaller in the former than in the latter. There are other differences, particularly with regard to the structure of land holdings and the characteristics of farmers. The maximum size of holdings in former land is limited to 50 fed (21 ha) under the Agrarian Reform Act (ARL) that came into force in the early 1960s, and since then, even though the law was later abolished, farms have become increasingly smaller due to the application of inheritance rules. In the new lands, one can find large farms of up to 1000 Fed (420 ha) owned by local and Arab companies and large investors, some of which produce for export agricultural products and raw materials for agribusiness (Egyptian country Report).

In Tunisia, the latest structure survey (2004-2005) reveals an increase in the number of agricultural holdings of nearly 10% between the three intercensal periods, while the UAA has remained stable (5,206,000 ha in 1960-62, 5,271,000 ha in 2004-2005), which translates into a decrease in the average area per farm (from 16 ha in 1960-62 to less than 10 ha in 2004-2005).

More than half (54%) of farms have less than 5 ha and hold 11% of agricultural areas, and farms of less than 10 ha which accounted for 63% of total holdings in 1960-62 accounted for 75% in 2004-2005 (ONAGRI, 2006). Holdings with an area of more than 50 ha account for only 3% of all holdings and account for 34% of agricultural land. Finally, the average number of plots was 1.8 in 2004.

Compared with 1994, there has been no major change in the structure of the crop area. Cereals account for almost the same proportion of 37% with a total area of 1,610,000 ha, an increase of 5.2% compared to 1994. The area under trees still accounts for half of the area under cultivation at 2,155,000 ha (Tunisia country report).

In Algeria, the most recent general census of agriculture in 2001 counted 1,023,799 private holdings consisting of private and collective farms. More than 70% of holdings occupying more than 25% of the UAA have an area of less than 10 hectares. Intermediate-sized holdings, covering an area of 10 to 50 hectares, hold about 51.8% of the total UAA and account for 22.6% of the total number of holdings. The average area per farm is closer to 8.5 ha, and a decline has been further accentuated in recent years by land reforms on public land.

In Morocco, according to the 1996 census, there were 1.5 million farms with an average size of 5.8 ha. Landless farmers and very small farmers (with holdings of less than 3 ha), whose main resource is labour power and extensive livestock, accounted for more than half of farms in Morocco (54%), and held 12% of the UAA and 18% of the irrigated area. The majority of these farms, which used to practice self-subsistence agriculture, are highly vulnerable to drought and even in normal times rely on external income from the farm, such as rural services and remittances from the diaspora. These holdings are concentrated on marginal piedmont and mountain lands, on unfavourable bour and on cleared land in steppe areas and oases. In contrast to small-scale agriculture, there is a "modern sector" consisting of 150,000 farms, accounting for 22% of the UAA and 30% of the irrigated UAA. This sector is well equipped, well integrated into the market, and eligible for bank credit and public aid (Morocco national report). Most agropastoral land is dominated by collective land, followed by individually owned land, and then forestry.

In Morocco, there is a plurality of legal land tenure systems. Muslim law, with its rules for the transmission of property and inheritance, governs melk (individual) and habous (public and private religious foundations) property. It is customary law that governs arch (tribal) ownership or collective land with governance led by rural communities. Positive law applies to land belonging to the public or private domain of the State. Morocco is currently carrying out one of the largest land reform projects. Several million hectares of land belonging to local authorities will be registered, for the benefit of collectivists, with the stated aim of starting the largest land modernization project in post-independence Morocco. Many collective lands have been melkised as a result. In view of these dynamics, it is difficult to give the exact proportion of each type of land. We will limit ourselves to the proportions referenced in 2008.

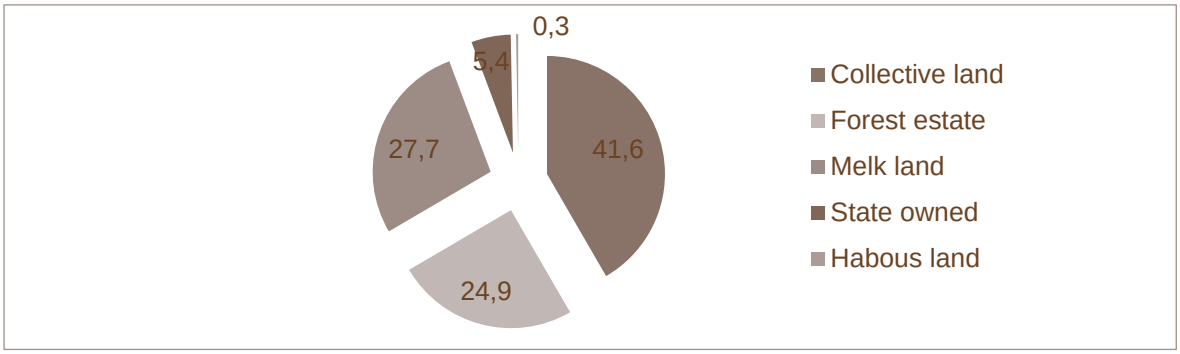


Figure 5: Land tenure status in Morocco.

Source: Morocco national report, documents from the Directorate of Rural Affairs. 2008

In Mauritania, some pastoral systems (nomadic, sedentary livestock farming associated with agriculture, extensive urban farming) are family farming; other pastoral systems, known as transhumant agropastoral systems and semi-intensive peri-urban farming systems, involve other actors (civil servants or traders). The active actors in the red meat sector are estimated at 105,385 farmers, 10,000 livestock traders, 2000 goatherds and 5,000 butchers (PNDE 2018). For cultivated products, rice and sugar cane are the most important ones (below Box). COVID has brought back to the forefront of the Mauritanian agenda the need to ensure self-sufficiency in fruit and vegetables, particularly around the capital and for its supply.

Box 3: Cultivation of rice and sugar cane in Mauritania

Rice farms are divided into 3 categories: (i) large collective areas where the management and maintenance of irrigation facilities are entrusted to farmers' organizations; (ii) village perimeters allocated to smallholder family farmers; (iii) and private operators or traders. At the level of the collective perimeters managed by the village cooperatives, the farm is fragmented and cramped with plots of an average size of about 0.7 ha. These farms are not very mechanized and rely on family labour, which is increasingly limited because of the emigration of young people and the most able-bodied workers. Rice producers are of two types: (i) small-scale producers organized in cooperatives, located all along the river valley and its branches (Foum, Rkiz, Koundi, etc.), and whose vocation is to ensure the food security of their households; (ii) "individual" producers who are promoters/investors for commercial purposes. Traditional cereal cultivation (millet, sorghum, maize) is dominated by small family or collective farms, with rudimentary agricultural practices and oriented towards self-subsistence. They are small family farms.

Sugarcane cultivation has recently been introduced in Mauritania as part of the creation of an agro-industrial complex for sugar production. This is an initiative that the Government has undertaken to implement structuring development projects, as well as to launch, among other things, the production and industrialization of a product that is highly consumed by the population. As part of a public-private partnership, the State has made 17,000 hectares downstream of the Foum Gleïta dam available to the project and has initiated several contacts with private partners to mobilize financing

Source: Mauritania country report

While in all these countries of North Africa, major public interventions have made it possible to develop land in order to gain arable soil, to invest in the mobilization of agricultural water by means of dams and hill reservoirs or an increase in the number of boreholes for the exploitation of groundwater, the constraints of relief and climate are still constraining.

2.6.3. Agro-climatic constraints

Large agricultural areas of this region remain subject to aridity or semi-aridity because the rains are very irregular, too early or too late, with freezing springs, sirocco in summer. The average annual rainfall over the period 1995-2016 is about 47 mm in Mauritania, 83 mm in Algeria, 315 mm in Morocco and 271 mm in Tunisia (RED, 2020)[15]. They are far lower than those of France (841 mm), Spain (610 mm) or Italy (927 mm). Due to low rainfall and high temperatures, soil moisture remains very low, limiting the potential of rain-fed agriculture, which occupies most of the arable land.

In Algeria, mountains dominate the landscape, and most of the country's agricultural territory is located in the arid and semi-arid area, which accounts for 85% of the total land area (excluding the Sahara) and is home to 60% of the agricultural population. Average rainfall is 89 mm/year, with potential evapotranspiration ranging from 800 mm in the northeast to more than 2,200 mm in the southeast, reflecting the scarcity of land in humid or sub-humid bioclimatic zones (Algeria country report). Agro-climatic constraints are reflected in the predominance of diversified cereal systems throughout the country (below Box).

Box 4: Agro-climatic constraints in Algeria and the dominance of cereal systems

Agro-climatic constraints in Algeria force farmers to adopt extensive cropping systems in rainfed areas. In 2020, more than half of the utilised agricultural area (UAA) was devoted to arable crops, mainly cereals. With more than a third of the national UAA (37.3%) fallow, the cereal/set-aside system accounts for more than 80% of the total UAA and covers almost 60% of farms. Cereals dominate in the semi-arid areas of the High Tellian Plains, the sub-arid areas of the Highlands, and the wetlands and sub-humid of the littoral and sub-littoral regions. Arboriculture, which covers just over 10% of the UAA, focuses on plantations of olive, fig, date palm, and fruit trees.

Source: Algeria country report

In Morocco, large-scale irrigation schemes and rainfed areas (plains and hills) with an average rainfall of more than 400 mm (known as "favourable Bour") have a relatively high productive potential. These areas account for only one-third of the UAA. They also account for only a quarter of farms and 64% of the country's total irrigated land. They are, in general, well served in terms of socio-economic services and infrastructure and have the assets to compete internationally.

Less favourable areas (semi-arid agricultural plains and plateaus, mountains and steppes, oasis areas) make up the dominant remainder, accounting for 2 thirds of the UAA, 3 quarters of agricultural holdings, and 36% of the irrigated UAA. The majority of these areas correspond to pastoral or agrosilvopastoral areas and to

[15] Source: World Bank 2016.

traditional irrigation fed mainly by surface water (through seguias). These areas are subject to multiple constraints, characterized in particular by: (i) low availability of water resources and (often degraded) soils; (ii) inadequate provision of basic socio-economic facilities (roads, water, electricity, etc.); (iii) weak technical supervision; (iv) high levels of illiteracy and low health coverage; and (v) municipalities with still high levels of poverty and vulnerability (Morocco country report).

Favourable areas (the favourable "*bour*" and irrigated in arid areas) occupy only a third of the UAA.

In Tunisia, the humid and subhumid bioclimatic level represents barely 1/5 of the territory, and the rest of the agricultural area is located in the arid, semi-arid or Saharan bioclimatic levels. The country has a predominantly semi-arid to irregular rainfall, which can vary from 1500 mm in the extreme north to less than 50 mm in the extreme south, with the possibility of torrential rains or periods of drought. In recent years, droughts have followed one another as a result of climate change, with impacts on production and water reserves (Tunisia country report).

Mauritania and Egypt face the constraints linked to the strongest climatic conditions. In Mauritania, the arid Sahelo-Saharan desert climate is characterized by desertification, and punctuated by repeated droughts. The arid zone covers 80% of the territory. The Sahelian zones (East and West) are characterized by a summer rainy season that alternates with a dry winter season. The Senegal River Valley area, which covers only 2% of the country's total area, is the area that has water resources and vegetation cover for the development of agro-sylvo-pastoral activities (175,000 ha, or 34% of the UAA). Finally, the maritime zone covers a narrow 50 km wide coastal strip that stretches from Nouadhibou to the mouth of the Senegal River (12,000 ha, or 2%, currently very underexploited). The arid zone (16,000 ha, or 3%), and the Sahelian zone (310,000 ha, or 61%) occupy more than a third of the country's arable land (Mauritania country report).

Egypt has a vast area of more than 100 million hectares, but due to the hot desert climate and extremely limited rainfall, only about 3.9 per cent is suitable for agriculture and the rest of the area (about 94 per cent) is desert, with extreme aridity. Thus, the total agricultural land (planted) amounts to about 3.95 million hectares, of which 65% (2.56 million hectares) represent the fertile "old lands" of the Nile Valley and Delta; the remaining 1.39 million hectares represent the "new land" outside the Nile Valley and Delta region. This cultivated area in the new land is the result of a long development programme implemented mainly by the state government in the 1960s and aimed at meeting the growing food demand, absorbing the population, and mitigating the density of the rural population in the old lands (Egypt country report).

Algeria and Morocco have mountainous regions with specific agriculture (predominantly agro-sylvo-pastoral with extensive polyculture associated with livestock farming and the exploitation of forest resources).[16] However, these mountain farms, which benefit from significant rainfall, are severely handicapped by the relief. When we compare topography and bioclimates, it is very clear that there is a constraint that is specific to agriculture in Morocco and Algeria. There is a dissociation between the rainfall gradient and the flatness gradient, the majority of the interior plains suitable for agricultural activity are marked by aridity or semi-aridity, and the majority of wetlands are mountainous.

[16] Tellian Atlas in the North and Saharan Atlas in the South for Algeria and Rif, Middle Atlas, High Atlas and Anti-Atlas for Morocco. In Morocco, these mountains represent nearly 1/5 of the population (mostly rural), and concentrate 1/4 of the farms occupying 14% of the UAA. In Algeria, it represents 20% of the UAA with nearly 3 million rural residents.

A large part of the arable land in this region is located in the arid-semi-arid or even Saharan triangle. The trend towards aridification of this region, which has been progressing over the last few decades, is increasingly constraining rain-fed agriculture in these 4 countries.

Demographic dynamics, combined with largely intensive agricultural policies, have accelerated the deterioration of scarce natural resources.

2.7. Degradation of Agrosystems

The various agroecosystems that dominate the region (traditional irrigated agriculture and high-productivity irrigated agriculture, rain-fed agriculture, pastoral and agro-sylvo-pastoral systems) are subject to severe degradation.

2.7.1. Advanced degradation of arable soils

All NATAE countries have reported losses of arable land in recent decades.

These losses of agricultural land are the result of multiple factors that combine to combine: urbanization processes, strong erosion and degradation of watersheds, salinization and sodification in irrigated areas, desertification of steppe rangelands, and finally a decrease in forest biomass linked to an increase in fires caused by scorching heat.

In Morocco, the National Action Plan to Combat Desertification indicates that nearly 64 per cent of the utilised agricultural area (UAA) is already subject to a land degradation process. Mountain, oasis and steppe areas are affected by erosion or desertification. More than 8 million ha of rangeland is severely degraded. The deterioration of forest cover in Morocco is also estimated at 17,000 hectares per year, with a reforestation success rate that does not exceed 48% in two years due to land clearing and forest fires[17].

In Tunisia, soils are generally poor in organic matter. On average, it does not exceed 0.5%[18], resulting in a very low level of fertility. This level of fertility has an impact on crop productivity, which is often improved by the excessive use of mineral and especially nitrogen fertilizers, which leads to a degradation of soil structure (FAO, 2017). All anthropogenic factors of degradation (ploughing of marginal land, poor land use, degrading cultivation practices) produce a synergistic effect on the degradation of soil resources (Tunisia country report). Vulnerability to erosion is also another problem of Tunisian soils. Erosion has a negative impact on agricultural productivity and dam storage capacity (Chebbi et al., 2019).

Empirical estimates by the Directorate General show that about three million hectares are affected by water and wind erosion (i.e., 20% of the total surface area of the country), including one million hectares threatened by particularly intense water erosion. The irreversible loss of cultivable soil by the latter reaches 10000 ha/year[19].

[17] Kingdom of Morocco. Ministry of Agriculture, Fisheries, Rural Development, Water and Forestry. Morocco (2020). Morocco's Forests Strategy 2020-2030.
[18] Tunisia National Report in Chapter 9
[19] Aissaoui C., and Ben Ghazi, A. (2023). Quantification de l'érosion hydrique en nappe dans la moyenne vallée de l'Oued Sarrath (Haut-Tell, Tunisie). VertigO - la revue électronique en sciences de l'environnement [En ligne], Regards / Terrain. DOI : https://doi.org/10.4000/vertigo.40615 . Annual land loss in these regions was estimated at 23,000 ha in the 2010s, of which 13,000 ha was irreversibly lost.
Bessaoud, O (2011). Les politiques publiques de modernisation agricole au Maghreb, enjeux et défis pour le futur in Dahou, T., Elloumi, M., Molle, F., Gassab, M et Romagny, B (sous la direction). *Pouvoirs, sociétés, et nature au sud de la Méditerranée*. Editions Karthala. pp 81-108.

Groundwater is used in an abusive manner with an exploitation rate of 118% for surface aquifers and 129% for deep aquifers (Tunisia country report). This overexploitation has led to a reduction in water levels and a deterioration in water quality

In Algeria, desertification poses a threat to the 32 million hectares of rangeland. The increase in the frequency of extreme weather events has exacerbated land degradation. This degradation is already a cause for concern, as it leads to a decrease or even disappearance of the initial biological productivity potential of cropland, rangeland, pasture and forest. In addition, areas deforested following fires (Boumerdès, Bouira, Tizi Ouzou, Bejaïa, Jijel) in recent years are even more susceptible to erosion, which exacerbates soil degradation. This degradation limits the possibilities for groundwater regeneration and accelerates the siltation process of reservoirs and dams built to build water reserves (Algeria country report). The forest cover of northern Algeria has been particularly exposed to fire risk in recent years, and each year, some 20,000 hectares are destroyed by fires (WB, 2023)[20].

According to the Med ECC, deserts will spread to Morocco, Algeria and Tunisia (MedECC, 2020).21 This soil degradation would be at the limit of the reversibility and resilience capacity of certain agrosystems (mountains, steppes or oases).

In Mauritania, raw, young, skeletal, poorly differentiated mineral soils developed on ergs and rocks cover about 80% of the country. Several decades of drought have led to a severe degradation of natural resources and desertification aggravated by human action, with direct consequences on an already very fragile natural environment. The potential of pastures, which depend mainly on the Sahelian ecosystem and the ecosystem of the river area, amounts to 13,848,000 ha, or about 14% of the total area of the country (source: SNCZH 2014, in Mauritania country report). About 479,000 ha/year are destroyed by bush fires, this corresponds to about 10 billion ouguiya in livestock feed equivalent. The evolution of livestock farming has led to a more than tripling of cattle and a doubling of goats and sheep between 2001 and 2015. This situation increases pressure, overgrazing and the risk of degradation of Sahelian ecosystems. In addition, the trend towards sedentarization of nomadic herders, only 5% today, accelerates overgrazing, particularly around ponds and human settlements. The current grazing deficit is around 1 to 2 million BTU/year. Typically, this deficit is compensated by aerial grazing (forest NTFPs and other woodlands), increasing pressure on forests and other woodlands (SNBPA, 2011-2020, in Mauritania country report). Sahelian ecosystems and wetlands (oases and ponds) are also highly unbalanced by the effects of droughts and especially by human activities. If current trends of degradation of the natural environment continue in Mauritania, the potential to enhance the country's plant and faunal biological diversity will be lost and their rehabilitation will be long and difficult (SNBPA, 2011-2020, in Mauritania country report).

In Egypt, wind erosion and silting up affect a large part of the territory and result in a loss of fertility of the soils used for cultivation.

[20] World Bank (2023). "Note on Algerian Forests: Sustainable Forest Management to Fight Forest Fires". pp 112
[21] MedECC (2020). *Risks related to climate and environmental change in the Mediterranean region*, 34 p. MedECC is an open and independent network of more than 600 scientists working to create a regional science-policy interface on climate and environmental change in the Mediterranean.

Wind erosion is considered one of the major causes of desertification over more than 90 per cent of the state's land area, in the Eastern and Western Deserts and in Sinai. These areas are characterized by a fragile ecosystem, severe drought and scarcity of vegetation cover.

Studies indicate that the wind erosion rate in Egypt is about 5.5 tons/hectare per year in the oases of the Western Desert and 71 to 100 tons/hectare per year in the rainfed areas of the northwest coast, (NAP report 2005; Wassif, 2002). Dunes pose a serious threat to reclaimed land, which is considered the most vulnerable to wind erosion. Sand dunes cover an area of more than 166,000 square kilometres, or 16.6% of Egypt's total land area (Wassif, 2002) and compromise many activities, both rural and urban.

In the Nile Valley and Delta up to the western and eastern borders of the country, the causes of land degradation are soil salinity, soil and water contamination. This region, which is home to about 3,571,428 ha (8.5 million feddans), is characterized by a high population density and intensive use of water and land resources. Intensive use of irrigation water with inefficient surface irrigation systems and drainage systems results in a high level of groundwater and soil salinity, resulting in about 30-40% of the floodplain area being affected by salinity, as well as increased use of chemical fertilizers and pesticides. This leads to soil and water contamination.

Affected by recurrent droughts in recent years, water resources are becoming scarcer, thus weakening the water security of these countries.

2.7.2. Severely weakened water security

In Algeria, water resources generally fall into three distinct categories. First, there are renewable surface water resources, which are estimated at around 10 billion cubic meters per year for the entire country, including the Sahara. Despite its vast expanse, the Sahara contributes only a potential of 0.2 billion cubic meters. Then there are the renewable groundwater resources, totalling about 2 billion cubic meters per year, mainly in the aquifers in the north of the country, fed by rainfall. Finally, there are the groundwater resources of the Continental Intercalaire and Terminal Complex aquifers, located in the south of the country. These two large deep aquifer systems are marginally not renewable, which makes them particularly fragile and requires extremely careful management to ensure their sustainability. The potential of these aquifer systems is estimated at 40,000 billion cubic meters (Algeria country report).

Being located in a water-scarce region of North Africa, Algeria is likely to experience more prolonged drought periods in the future, due to the threats posed by climate change in the region. This lack of available resources is further exacerbated by several factors:

- The unequal spatial distribution of water resources.
- Erosion and siltation of dams.
- Losses due to obsolescence of distribution networks and lack of management, servicing and maintenance.
- Pollution phenomena.
- Inadequate catchment infrastructure.
- The high costs of investments needed to mobilize and transfer water resources.

According to the country report, Tunisia records 400 m³ of water per capita per year and is below the water stress threshold of 500 m³ per capita per year. The level of water stress in Tunisia increased to a value of 109.7% in 2020 (below Figure). Agriculture uses 79% of the global water volume with 2.933 billion m³ used for irrigation in 2019. The drinking water sector uses nearly 19% of resources (MARHP, 2020, in Tunisia country report).

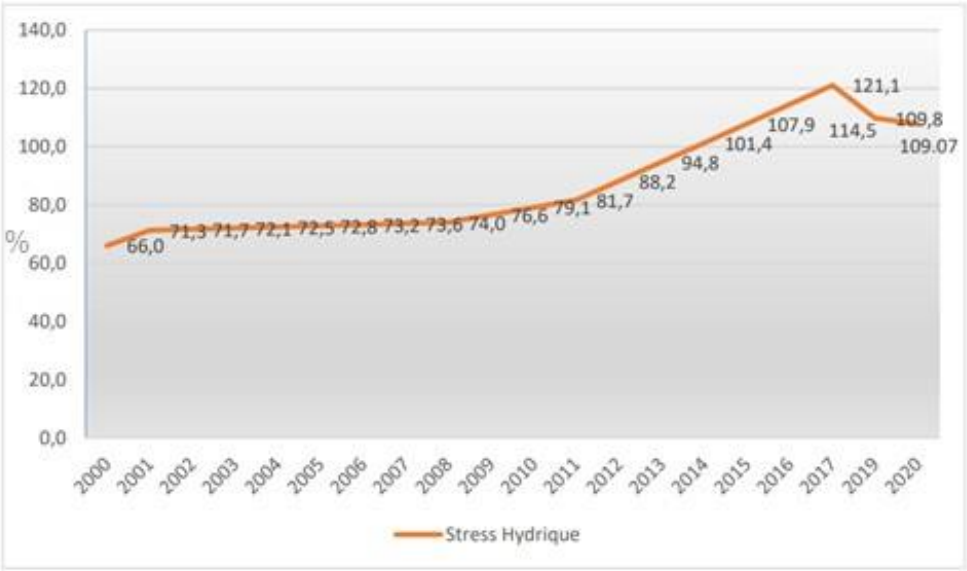


Figure 6: Evolution of water stress in Tunisia (2020).

Source: MARHP. Tunisia, country report

In Mauritania, surface water is mainly made up of the Senegal River and its tributaries. Only 100 million m³ of the 11.1 billion m³/year of renewable surface water (MHA, 2012, in Mauritanie country report) is generated in the interior of the country and the 405 reservoirs (dams and dikes with a total capacity of 900 million m³, including 500 million m³ for the Foum Gleita dam (MEDD, 2010, in Mauritania country report) are the main possibility of mobilizing temporary surface water. The country has significant groundwater resources, although they are characterized by large geographical disparities, and some of the most important aquifers are located in desert areas far from urban centres. Renewable groundwater is estimated at 300 million m³/year (MHA, 2012, in Mauritania country report). Water quality has deteriorated as a result of the consequences of the drought of the 1970s and anthropogenic action. This has led to the phenomena of salinization, silting up of watercourses, sedimentation, proliferation of invasive aquatic plants and various types of pollution, in particular caused by poorly adapted irrigation techniques leading to the infiltration of fertilizers and pesticides. Pollution of the river by irrigation and salinization has been observed several times and overexploitation of groundwater has been observed in several oases (Abdel Kader Ould Mohamed-Saleck, 2010).

In Egypt, the annual availability of renewable water is 59.7 billion m3 and the available water per capita is 574 m³ of water per capita (FAO, 2022). There is virtually no rainfall and the country depends almost entirely (80%) on the Nile (whose source is outside Egypt) for its water needs. Water mobilization differs across agro-ecological zones (below Box). The Nile is the main source of irrigation for the Nile Valley lands, or ancient lands. Traditional

soil fertility management can lead to nutrient extraction from the soil due to insufficient nutrient application, nutrient imbalances, and contamination of the environment; water and soil, due to overapplication of fertilizers.

In terms of new land, Nile water generally remains the main source of irrigation water, but in some desert areas, groundwater is the only source of agricultural water. Initially, this new land was not fertile. However, over time, through good soil and water management techniques (especially the incorporation of compost and crop residues), their productivity improves and, in prosperous areas, eventually approaches that of the old land. Sprinkler and drip irrigation regimes are practised.

Box 5: Diversity of agro-ecological zones in Egypt

Depending on the characteristics of soil and water resources, agricultural land can be classified into four agro-ecological zones: old land, new land, oases, and rainfed areas. The former land area is located in the Nile Valley and Delta regions and covers a total area of 2.5 million hectares (65% of the total cultivated land) and is characterized by alluvial (clay to silty), deep, flat and fertile soils. The Nile is the main source of irrigation for these lands

The area of the new lands is mainly to the east and west of the delta and is scattered throughout various parts of the country. The new land, which covers an area of 1.3 million hectares (35% of total cropland), is mainly in the desert, outside the areas of the former Delta Valley, and has been rehabilitated for cultivation. Reclamation of these lands began in the early 1950s and is ongoing. Nile water is usually the main source of irrigation water, but in some desert areas, groundwater is the only source of irrigation water.

The Oasis area is characterized by alluvial, sandy and calcareous soils. It covers a total area of 40,000 ha. Groundwater is the main source of irrigation.

The rainfed zone comprises about 0.17 million hectares of land located in the northern coastal regions, where rainfall fluctuates between 100 and 200 mm per year.

Source: Egypt Country Report

The deterioration of water resources is as much about quantity as it is about quality: salinization of irrigation water is observed in all countries (national reports). Water stress levels are already a concern in three countries (Egypt, Algeria, Tunisia) and to a lesser extent in Morocco and Mauritania.

Table 9: Water stress[22] (%)- Renewable freshwater (Year 2019)

Country	Water stress level (%)	Renewable water (m^3/habit./year)
Mauritania	13,2	2 444
Morocco	50,8	620
Algeria	137,9	263

[22] Water stress : when water demand is higher than the amount available during a certain period of time, or when use is restricted because of low quality.

Tunisia	96,0	348
Egypt	141,2	574

Source: FAO, Statistical world book, 2022.

Algeria and Tunisia, followed by Morocco in recent years, are overexploiting their available renewable water resources and their water stress levels are tending towards severe water scarcity, as shown in Table 2. In Tunisia, the overall water mobilization rate, which was more than 90% in 2009-2010, reached a critical breaking point in 2020 (FAO, 2022)[23]. Algeria, which has a water mobilization rate of more than 137%, is among the top 10 countries mobilizing its water reserves (FAO, 2022). Morocco, with an exploitation of more than 50%, belongs to a group of countries with a risk of shortage in the future. Mauritania is under-exploited with a stress rate of 13.2% in 2019.

Per capita freshwater availability in 3 Maghreb countries (Morocco, Algeria and Tunisia) has fallen by more than 60% over the past 40 years[24]. Two countries, Algeria and Tunisia, are experiencing absolute water scarcity (with less than 500 m^3 per capita per year). The decrease in water supplies, combined with increased demand due to population growth and economic development, has put Morocco in a situation of water stress: between 1960 and 2020, the per capita availability of renewable water resources decreased from 2,560 m^3 to about 560 m^3 per person per year in 2022, placing Morocco in a situation of structural water stress (WB, 2022)[25]. Only Mauritania has an availability of 2,444 m^3/habit/year, well above the 1000 m^3/inhabitant/year that is the accepted norm. The crucial issue in this country is rather the ability to access this drinking water for poor populations living in regions that are under-equipped with infrastructure.

Variability and declining precipitation levels have led to a decrease in the actual volume of water in reservoirs over the past decade. Dams, which are currently struggling to fill up at the beginning of the season and meet the simultaneous need for quality drinking water and a high demand for irrigation water, are also facing the challenge of siltation (WB 2022)[26].

Box 6: Water scarcity, a zoom on the Central Maghreb countries, Algeria, Morocco and Tunisia

The water footprint far exceeds the water resources available in the three countries[27]. As a result of their levels of food imports, the Maghreb countries have a high dependence on external water resources, regional water environmental footprints higher than the world average, a worsening shortage of renewable water

[23] The exploitation rate would have been 109% for Tunisia in FAO. *Statistical World book. 2022*
[24] Moulay-Driss El Jihad, MD., Taabni, M (2017). L'eau au Maghreb : quel " mix " hydrique face aux effets du changement climatique ? in Zeineddine Nouaceur. Eau et climat en Afrique du Nord et au Moyen-Orient, Editions Transversal .p 11-25
[25] World Bank (2022). " *Morocco Climate and Development Report* ", October 2022. pp 34. This allocation could fall below 500 m3 per person per year by 2030, which corresponds to a situation of absolute shortage (World Bank*. Technical Note Water Scarcity and Droughts Climate and Development Report.* October 2022)
[26] In March 2024, the average filling rate of dams in Morocco was 26.3% (Ministry of Equipment and Water), 37.3% in Tunisia (National Observatory of Agriculture), and 48% in Algeria (National Agency for Dams). In Morocco, and according to the World Bank note cited, nearly 20 reservoirs or large dams will be completely silted up by 2040; (ii) almost half of the dam reservoirs will have lost about 50% of their capacity by 2050 and (iii) almost all of the small dams built are likely to be silted up by 2040 (WB, 2022).
[27] The water footprint is an indicator of the direct or indirect use that is made of water by a consumer or producer.
Water self-sufficiency is defined as the ratio of one's internal water footprint to one's total water footprint. The dependency ratio is defined by the ratio of its external water footprint to its total water footprint.

resources, an increase in the number and capacity of dams putting pressure on freshwater ecosystems[28], and an increased risk of conflicts between water users[29].

With water footprint values in the range of 1,050 to 2,200 m^3/year per capita, Tunisia (2,217 m^3/capita/year) is at the upper end of the range. Algeria's water "dependency rate" remains relatively high compared to its neighbours, which export fresh fruit and vegetables. Morocco has a smaller external water footprint, but exports more virtual water (240 million m^3 of blue water per year) than neighbouring countries, while its surface water supplies tend to decline[30]. These surface water inputs have fallen since 1979 from an annual average of 22 billion m^3 between 1945 and 1978, to an annual average of 15 billion m^3 between 1979 and 2018. Groundwater withdrawals amounted to about five billion m^3 per year, which is 28% (1.1 billion m^3 per year) higher than the estimated level of renewable groundwater sources (WB, 2022).31

In Algeria, due to the overexploitation of groundwater, in some regions of the Tell we are witnessing the disappearance of artesianism or the drawdown of aquifers, resulting in the decline of certain irrigated crops (the case of potatoes in the production basin of the wilaya of Mascara). The soils of the oases are also degraded by the rise of water tables and salt (as in the palm groves of M'ghaier, Biskra, Tolga, Touggourt, Oued Souf and Ouargla). One of the major risks, in addition to the water scarcity observed in Tunisia, is the deterioration of water quality in coastal oases (Gabés) following sea level rise and the probable penetration of saline marine waters into local aquifers (OSS, 2016).[32]

Source: literature review

As access to water remains a major issue in the region, territorial divisions between coastal urban areas and remote rural areas are increasing, exposing rural populations and smallholder farmers in particular to high water insecurity.

2.7.3. Synthesis

With regard to natural resources, the major concern is the decline in water availability, due to a reduced supply (decrease in precipitation, overexploitation of groundwater resources, siltation and drying of dams, reservoirs and of lakes) and an increasing demand (demographic growth, and expansion of irrigated agriculture), for domestic consumption and for agriculture. The countries of North Africa are in a situation of water stress. Demographic dynamics, combined with largely intensive agricultural policies, have accelerated the deterioration of scarce natural resources and led to soil erosion and desertification processes.

Since their independence, the Mediterranean North African countries (Algeria, Egypt, Morocco and Tunisia) have devoted a central place to the mobilization and management of water in agricultural development policy, with large dedicated infrastructures, the construction of dams and canals, the mobilization of groundwater, the

[28] Morocco now has 153 large dams, with a total capacity exceeding 19.9 billion m3 of water, as well as 141 small dams. Eighteen large dams are under construction, while a 19th project will be launched next year according to the 2024 Finance Law. The number of dams in Algeria amounts to 81 dams with a total capacity of more than 9 billion m3. Tunisia has 31 dams and hillside reservoirs with a capacity of more than 2.5 billion m3.
[29] These conflicts are now increasingly pitting domestic users against agricultural, industrial and tourist uses.
[30] The water dependency ratio is defined as the ratio of its external water footprint to its total water footprint.
[31] See BM (2022). "Technical Note." already cited
[32] Observatoire du Sahel et du Sahara. OSS (2016). Les changements climatiques dans la zone d'action de l'OSS entre vulnérabilité et adaptation. pp 17

establishment of irrigated areas. In Mauritania, the development of livestock farming is predominant, and the main irrigated areas are located along the Senegal River and near the capital.

Since the mid-2000s, these national water policies initially based on supply have gradually moved towards sustainable strategies or rationalization of water uses, with regulations and measures intended to save water becoming rarer and to regulate demand.

Concretely, for 20 years, the transition from gravity to drip irrigation has constituted a large-scale change in irrigation practices in Morocco, Tunisia and Algeria and to a lesser extent in Egypt. However, the growth in irrigated areas has not led to reductions in consumption in the sector.

2.7.4. The Effect of Climate Change on Natural Resources

The rise in temperature and precipitation is evidenced by the projections made by a large number of studies, including that of the IPCC (IPCC, 2023). All climate models and scenarios predict a sharp increase in heat waves, a decrease in precipitation and an occurrence of extreme drought events in the 4 Maghreb countries.

All countries have a mean annual temperature change at least 1.0 °C higher than the 1951–1980 average in 2020 (below table); the largest mean annual temperature change, compared to all countries in the world was recorded in Tunisia (FAO statistical yearbook, 2022). Soil moisture, which is an important indicator of drought, shows real degradation[33].

Table 10: Temperature change measured on the ground (2021)

Country	Temperature rise (in C°)
Mauritania	1,86
Morocco	1,88
Algeria	2,30
Tunisia	2,54
Egypt	1,61

Source: FAO, Statistical world book. 2022

Egypt is one of the most vulnerable countries to the potential effects and risks of climate change. There is virtually no rain and it depends entirely (80%) on the Nile whose source is outside Egypt for its water needs. Precipitation has only a minimal impact on the economy; therefore, climate effects on water supply are indirect and may result from impacts on the Nile's main sources. Egypt's agriculture and food systems are vulnerable to potential climate change due to their dependence on irrigated crops.

[33] In addition to soil parameters, this indicator depends on both precipitation and evapotranspiration and, therefore, also on temperature, since rising temperatures lead to an increase in potential evapotranspiration.

The climate is too dry to support crops and the need for water is increasing. Climate change would lead to a substantial reduction in agricultural productivity (box 4). Egypt's Nile Delta and its coastal front on the Mediterranean are also considered vulnerable to coastal changes due to erosion and accretion, subsidence and sea-level rise due to climate change.

Box 7: Climate pressures on water and agriculture in Egypt

The vast majority of crops are irrigated from Nile water creating great vulnerability to reductions in Nile flow. Climate change also increases crop evapotranspiration needs and can reduce yields creating vulnerability. Simultaneously, potential evapotranspiration from crops, an indicator of irrigation water demand, is expected to rise by up to 21% (Perez et al. 2021). Furthermore, agricultural lands in the Nile Delta face the threat of inundation from sea level rise (McCarl et al. 2015). Inundation along coastal areas would also lead to destruction of property and disruption of the proper functioning of infrastructure facilities directly exposed to the sea. There might be significant reduction in the agricultural production of Egypt since it is estimated that about 30-40% of Egypt's agricultural production is generated from the low-lying areas of the north Delta governorates that are susceptible to sea level rise (McCarl et al., 2015).

The natural agricultural resources in Egypt are under constant threat due to climate change and increasing human pressures. As temperatures are expected to increase, and consequently, the increase in the gap between available water resources and actual needs (FAO. 2021). Expectations have shown a significant decrease in wheat production in the period between 2012 and 2040 at a rate ranging from 11 to 12%, from 26 to 47% in rice, and from 40 to 47% in maize production (Mwenge Kahinda et al. 2021).

Source: Egypt Country Report

In Morocco, apart from the distribution of rainfall through the seasons, it appears that the overall rainfall volume during the decade 2013-2022 exceeded the level of the climatological norm – for the period 1981-2010 – only twice, compared to 7 times for the decade preceding 2003-2012. The very low rainfall level, i.e. below 150 mm, recorded during 2017 and, repeatedly, from 2019 to 2022, was the exception, which occurred only 4 times in 30 years, between 1985 and 2016.

The annual average temperature anomaly for the year 2022 is about 1.63°C at the national level compared to the climatological normal calculated over the period 1981-2010. It represents the highest anomaly since 1981, followed by 1.37°C recorded in 2020 and 1.33°C recorded in 2017. The annual average temperatures at the national level in 2022, 2020 and 2017 were, respectively, 20.36°C, 20.1°C and 20.06°C.

With the exception of March (below Figure), all months recorded average temperatures above climatological norms - the average temperature for the period 1981-2010 - with new monthly mean temperature records in July, October, November and December. 2022 saw 288 days with above-normal average temperatures; i.e. 80% of the days of the year.

Morocco experienced the occurrence of 25 extreme weather events that were the subject of weather warning reports. Some of these extreme events have caused damage. Intense weather events in 2022 are distributed as follows: heavy thundershowers (44%), heat waves (20%), snowfall (20%) and strong winds (16%).(Morocco country report).

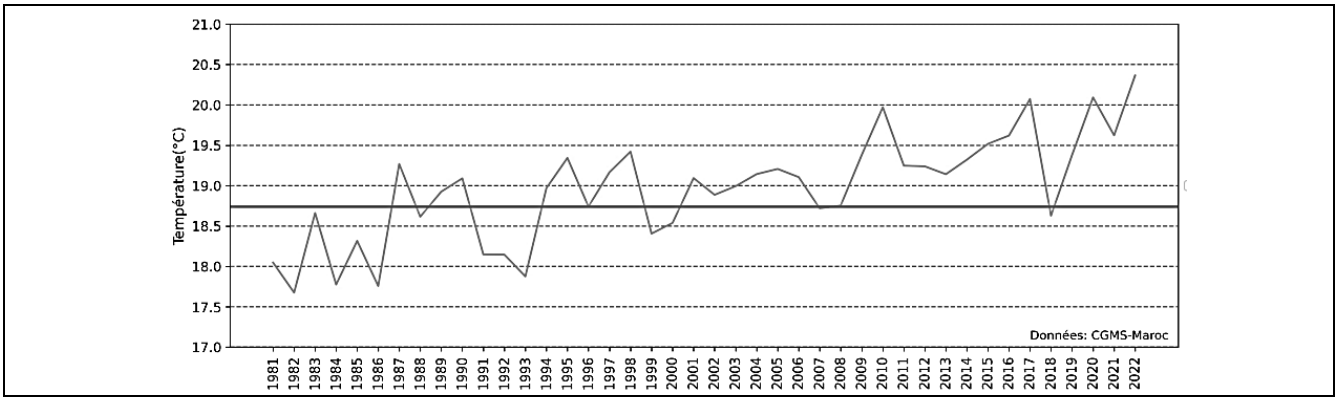


Figure 7: Evolution of the average temperature/year in Morocco.

Data source: State of the climate in 2022, CGMS-Morocco); Morocco Country Report

Algeria has experienced a succession of periods of drought, profoundly marking the climatic landscape of the region. These phases of water deficit have had a significant impact on the availability of water resources, exacerbating long-standing water management challenges. The evolution of temperatures on the Algerian coast observed in recent decades shows a significant increase since the mid-eighties (Nouaceur et al, 2013)[34]. Recurrent droughts have affected natural water resources. The measurement of water inflows in some dams in Algeria during the periods (1945-98), (1945-75) and (1976-98) also indicated that inflows had halved between a wet and dry period (Safar-Zitoun, 2019)[35]. Drought and climate degradation were the root cause. In the north of the country, in the catchment of the Chéliff, the most important river, projected climate change could reduce water flows by 34-40% in 2020 and by 60-78% by 2050.

Over time, these periods of drought have placed significant pressures on Algerian decision-makers, forcing them to take adaptation measures and rethink water management policies. The modes of governance adopted for irrigation water governance around the world are mainly motivated by the fight against climate change, which is causing water scarcity situations that are increasingly distant from the needs of populations and WHO standards (Alstom, 2016).

In Tunisia, climate change is expected to increase the temperature by 1.9°C by 2030 and 2.7°C by 2050, and that precipitation will decrease by 9% in 2030 and 17% in 2050 compared to the reference period (1961-1990). In this country, one of the major risks, in addition to water scarcity, is the deterioration of water quality in Tunisia's coastal oases (Gabés), following sea level rise and the likely penetration of saline marine waters into local aquifers (OSS, 2016)[36].

In Mauritania, climate change and its foreseeable effects on agriculture are worrying. According to climate scenarios (IPCC, 2023), the temperature in Mauritania is projected to increase by 2.0°C to 4.5°C by 2080 compared to pre-industrial levels, with higher and more extreme temperatures in the south and west of the

[34] Nouaceur, Z., Laignel,B., Turki, (2013). Changements climatiques au Maghreb : vers des conditions plus humides et plus chaudes sur le littoral algérien ? *Revue Géographie Physique et Environ*nement. Volume 7/2013, pp 307-3023
[35] Safar-Zitoun, M (2019). *Plan National sécheresse*. 88 p
[36] Observatoire du Sahel et du Sahara. OSS (2016). Les changements climatiques dans la zone d'action de l'OSS entre vulnérabilité et adaptation. pp 17

country. Precipitation projections range from a slight increase to a decrease in annual precipitation of up to 11 mm by 2080. Nevertheless, the coming dry and wet periods are expected to become more extreme. Over the next twenty years, the climate will change towards greater aridity, an increase in the frequency of extreme weather shocks and a decrease in precipitation.

Over the past 3 decades, the livestock sector has been marked by profound changes caused mainly by droughts causing a sharp decrease in livestock numbers and socio-economic disruptions within pastoral communities. Climate change has led to severe degradation of natural resources and desertification, which has been severely exacerbated by human action. In addition to the risks related to the vulnerability of the national economy to exogenous shocks, the impacts of climate change will particularly affect vital sectors of the national economy such as water resources, agricultural and livestock production, the coastal economy and natural ecosystem services. Ultimately, the pressure on natural resources will be more sustained for rural populations who derive most of their income from the exploitation of these resources (RIM, 2014). Their direct consequences are a deterioration of living conditions and the impoverishment of the rural population.

The agricultural sector now accounts for the bulk of water withdrawals in the North African region. The agricultural sector's share of water abstraction is 63.8% in Algeria, 85% for Egypt, 90.6% in Mauritania, 87.8% in Morocco and 76.3% in Tunisia. Increasing water scarcity as a result of climate change will affect irrigated crops, with negative consequences for agricultural production. This deterioration of the climate will naturally lead to the desertification of several million hectares and the loss of arable land in the 5 countries. Pastoral systems, which are home to a large proportion of the population, are particularly exposed to the risk of desertification.

The vulnerability of the South Mediterranean region to climate change remains a major challenge for these countries facing major issues of food security, employment and agricultural incomes.

2.8. Conclusion, Main Challenges and Issues of the Future

Countries have experienced high demographic growth before reaching their transition point except in Mauritania and Egypt where natural fecondity rate remain high. They are facing growing concerns with food security and safety, with increasing health costs due to the impacts of both unbalanced diets and to increased food insecurity. They massively import the cereals they need in spite of huge public investment for growing irrigated cereals, and since globalisation take place in the 1980ies and 1990ies, they were pushed to investing in higher added value crops (Egypt, Morocco and Tunisia) that rely on an intensive mobilisation of inputs included irrigation water. Algeria has also chosen to develop a Saharan agriculture dedicated notably to grow cereals, and based essentially on the mobilization of huge and non-renewable water resources. In Mauritania, the nutrition problems are less due to an overconsumption of fat and sugar, and more linked to the lack of access to food, especially for women and children. Same for the of water, the problem is more a lack of access to water for the inhabitants and the farmers (lack of infrastructure) than the absence of water as the country holds underground water resources whose mobilization rate remains low.

The agricultural sector of North African countries is mostly dual, (except for Mauritania being part of Sahelian zone with specific characteristics and where rangelands and livestock dominate): the number of farms is

predominant in all countries, and although latest available figures refer to periods from the late nineties (Morocco) to late 2000ies (Egypt), the agrarian structure is characterised by the importance of small and medium-sized farms, and by family farming predominance over a large majority of agricultural land and land investors do exist and mainly target the development of high value productions, such as horticulture and eventually organic agriculture.

Organic farming, which is present in Egypt, Morocco and Tunisia, is a niche sector often reserved for the elite, including many urban investors (particularly in Egypt), due to the high cost of access (knowledge of standards and processes, inspection costs, etc.). Most production is intended for experts, but national markets for this organic production exist and are developing, particularly in Egypt and Morocco. In Algeria and Mauritania, organic farming is becoming established. In most countries, the notion of local, healthy products to be promoted is leading to the development of value chains supported by urban consumers at the instigation of civil society. These local products are not necessarily organic and these initiatives remain localised, but these dynamics are important preliminaries for the development of a popular agroecology.

In order to meet the demographic challenge, the agricultural sector must first of all accompany the structural demographic changes marked by a rapid increase in an increasingly urbanized and settled population on the one hand and, on the other hand, an age pyramid that shows a preponderance of those under 25 years of age. These structural trends raise crucial questions. On the one hand, the very strong population growth is the result of a decline in mortality, which is an achievement of health progress. On the other hand, the "cohort" of young workers that "floods" into urban centres is considered either as a "demographic bonus" or as a "burden" due to the increase in the number of city dwellers and dependent people to feed. Whatever the point of view, the main challenge is both to meet the growing demand for food and to capture the benefits of this demographic dividend by securing as many young workers as possible. And finally, as far as youth employment is concerned, current agriculture can only continue to absorb a part of rural youth. Unable to find outlets in the rural environment and/or the modern formal sector, the alternative available to young workers is to live off expedients in the informal sector and/or to emigrate to neighbouring countries and countries in the North. Meeting the challenge of youth employment means completing the transition (or transformation) towards an integrated urban and rural economy. Changes in consumption patterns and access patterns to food products are leading to the development of new activities along food value chains. The activities generated represent a significant potential for employment for young people. The latter could invest in short-cycle livestock farming (especially urban livestock) and be involved in agri-food sectors (in production, processing, transport and sales).

Water access and availability are a huge and shared challenge for all countries agricultural perennity, the region being one hot-spot for climate change high temperature and low rainfall and its impacts. The land and water degradation combined with climate change pressure threaten agricultural production basis and hits strongly farmers, not among family farms and small farmers, but also in some bigger and industralised farms. During these last years, due to drought recurrence, several cases of family farms being abandoned and sold due the series of climate crises in an inflation context have been reported for most countries.

In all countries, the preservation of waters, combined with the effective implementation of climate change adaptation measures, are therefore essential conditions for the maintenance and development of agriculture, and the basis of the population's diet.

Increased pressure on natural resources can be a source of local or regional social conflicts over their use. The public authorities are called upon to arbitrate on access to resources in order to contribute to social cohesion and the necessary political equilibrium of countries and their territories. Such trade-offs, if made in time, are likely to regulate internal migration, and control regional and international migration.

The challenge for the future is to design new agricultural policies that take care of the identified constraints and ensure the availability of food products in quantity for the benefit of the population.

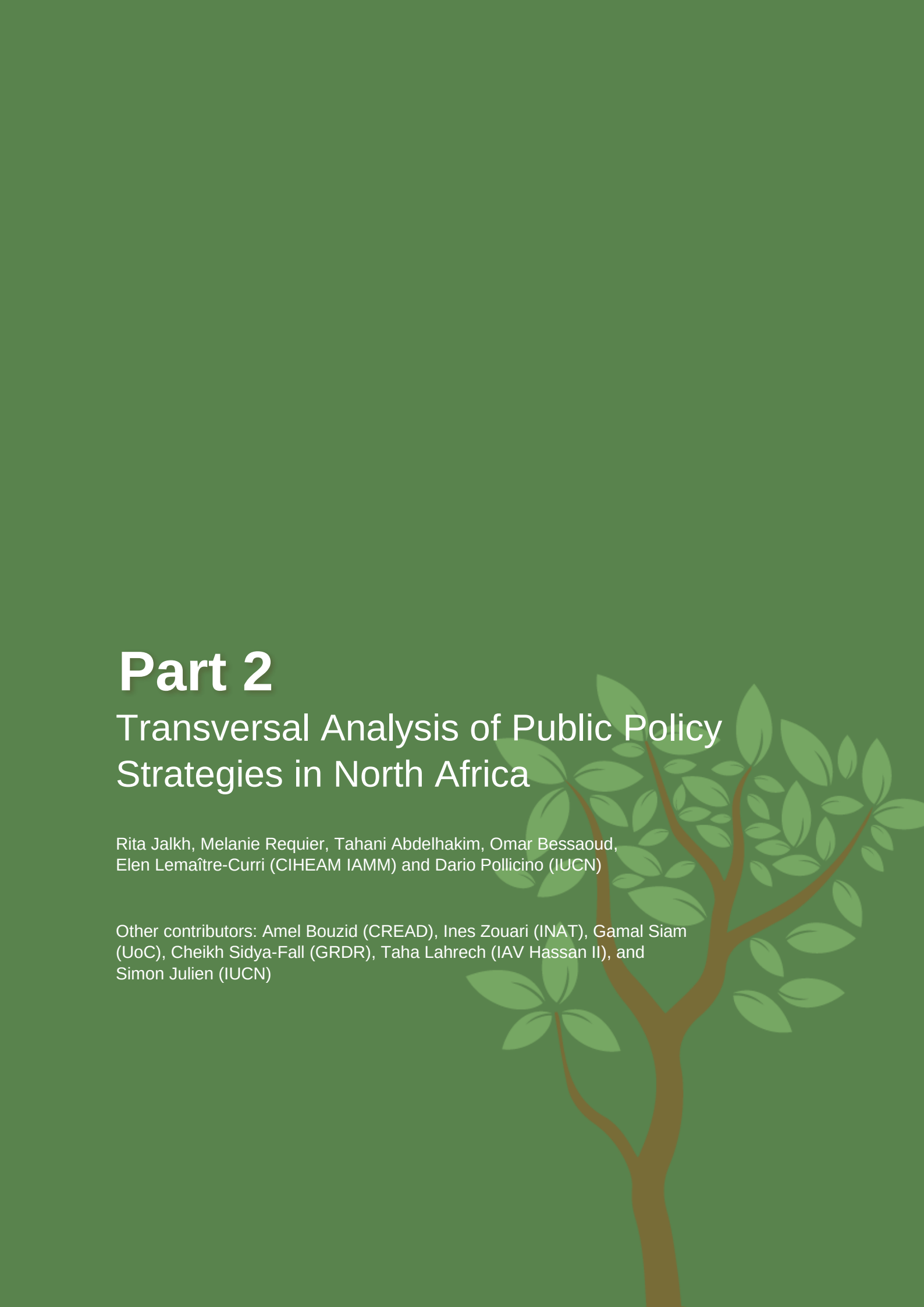
In this context, agroecology appears as a potential win-win option in the medium and long run. Organic agriculture and local and healthy products current dynamics are paving the forwards for the development of a more popular and accessible agroecological transition pathways which remain to be designed.

Part 2

Transversal Analysis of Public Policy Strategies in North Africa

Rita Jalkh, Melanie Requier, Tahani Abdelhakim, Omar Bessaoud, Elen Lemaître-Curri (CIHEAM IAMM) and Dario Pollicino (IUCN)

Other contributors: Amel Bouzid (CREAD), Ines Zouari (INAT), Gamal Siam (UoC), Cheikh Sidya-Fall (GRDR), Taha Lahrech (IAV Hassan II), and Simon Julien (IUCN)



PART 2: TRANSVERSAL ANALYSIS OF PUBLIC POLICY STRATEGIES IN NORTH AFRICA

Chapter Three **Public Policies in North Africa from the Perspective of Agroecology**

3.1. Introduction

Since the 1970s and 1980s, major public interventions and significant investments have been made by North African countries in the mobilization of agricultural water. They have enabled the water deficit to be lifted and real progress to be made in production. Pioneering fronts have emerged helping to draw a new cartography of production basins modeled on the rhythm of construction of dams, hill reservoirs, and exploitation of groundwater in the North or in the South (as is the case in Algeria and in Tunisia). At the same time, environmental strategies are being implemented to deal with the degradation of their natural resources.

Within the environmental dimension in public policies, two major historical sequences can be clearly distinguished. The *first sequence* of environmental care covers the decades 1970-1990. It was characterized by the adoption of water schemes and/or master plans, national reforestation programs, protection of watersheds, the construction of dams and small hydraulic works, the definition soil and water conservation programs and the protection of rangelands, the development of plans to combat desertification, etc. In the case of Maghreb countries, it also relates to the continuation to manage disadvantaged areas (mountains and steppe rangelands) inherited from colonization. Soil defense and restoration actions, reforestation programs as well as the development of marginal lands which had benefited from the concern of the colonial administration were renewed. Following the droughts of the 1970s, the Tunisian state focused its attention on water master plans, increased water mobilization actions and carried out water and soil conservation work. The rural development policies carried out during the 1980s-1990s in Algeria, Tunisia and Morocco combined measures to combat poverty with other measures to restore natural environments (against erosion, silting or deforestation), or specific infrastructure construction. These actions, driven by decentralized State services, take place mainly in fragile, arid or mountain regions. Inaugurated by the Earth Summit in Rio, 1992 was a pivotal year for all the countries. From this period onwards, they will display action programs for sustainable development. They have adhered to international conventions, including that concerning the fight against desertification (PNU-LCD), participated in the Multilateral Environmental Agreements (MEA), and proclaimed their intentions to adopt the methods of Agenda 21 to develop ecological and sustainable territorial projects. With the support of international institutions and non-governmental organizations (NGOs), North African countries continue to equip themselves with institutional and legislative frameworks integrating the management of natural resources into their strategic documents. The States still present in the governance of the approved programs will be strongly supported (particularly financially) by private structures, international cooperation agencies and/or institutions (FAO, WB, EU, GIZ, AFD, etc.), NGOs and regional authorities.

The second sequence which covers the decades 2000-2020 is rich in terms of institutional and legislative innovations. Countries adhere to major international conventions (United Nations Framework Convention on climate change, on biodiversity), ratify the Paris agreement on climate, etc.), promulgate laws relating to water, forests , mountains, biodiversity, etc., are equipped with national plans and strategies, agencies, observatories or ministerial institutions specifically dedicated to sustainable agricultural and rural development. Here too, many projects implemented benefit from assistance from international cooperation (United Nations, European Union, French Development Agency, etc.).

The analysis performed in this section distinguishes between agricultural, environmental, water strategies and strategies to combat climate change.

3.2. National Strategies Analysed

3.2.1. Listing of analysed national public policy strategies

One of the main steps of public policy analysis in North Africa was to consider the position and perspectives of agroecology while analysing the factors that encourage or hinder its application. Accordingly, one of the first steps applied was to select the main public policies that incorporate such information directly. Table 11 represents a list of public policies selected by the NATAE local partners in the targeted countries in North Africa including Egypt, Tunisia, Algeria, Morocco, and Mauritania. These consist the strategy documents that were inspected and analysed by the partners and therefore are not holistic of all policies within each country. Knowing that certain policies are transversal and cross-sectoral, this list was divided into four main themes under which the policies fit, including agricultural, environmental, climate change coping, and water-related strategies. Environmental strategies are inclusive of policies around biodiversity, desertification and wetlands.

Table 11: List of Public Policies analysed per each country in North Africa distributed between four major themes: Agricultural, environmental, climate change coping, and water-related.

Country	Agricultural Strategies	Environmental Strategies	CC Coping Strategies	Water-related Strategies
Egypt	Sustainable Agricultural Development Strategy (SADS) 2020-2030	Biodiversity Strategy and Action Plan (EBSAP) 2015-2030 National Action Plan to Combat Desertification (NAPCD)	National Climate Change Strategy (NCCS) 2050 National Determined Contribution (2030) CC components included in SADS and EBSAP strategic goal 5	National Water Resources Plan (NWRP) 2017-2037
Tunisia	National Action Plan on Sustainable Production and Consumption Patterns in Tunisia Ten-Year Agri-Food Action Plan 2016-2025	National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Tunisia (NSAPB) 2018-2030	National Determined Contribution (2030) CC components included in: *Axis 2 of the NSET strategy includes adaptation to CC.*	Water 2050 Strategy

		National Strategy for Ecological Transition (NSET) 2035-2050 National Action Programme to Combat Desertification (NAP-CD) 2018-2030	*Objective 3.1 and Action priority 4 of the NSAPB.* *Priority orientation 2 of the NAP-CD.* *Two strategies exist: National Low-Carbon Strategy (NLCS) (2022) and the National Strategy for Climate-Resilient Development (NSCRD) (2022) that link to agriculture.*	
Algeria	Agricultural Strategy 2020-2024	National Biodiversity Strategy and Action Plan (NBSAP) 2016-2030 Green Dam Rehabilitation Plan originally 1970 with vision 2023-2030 National Wetlands Strategy (NWS) 2015-2030 … in addition to legislation (No. 03-10 (2003) and 83-03 (1983))	National Determined Contribution (2030) National Climate Plan (2030) CC components included in the NWS	No standalone strategy. *Emergency drinking water programme by seawater desalination (2003) and irrigation water governance and management*
Morocco	Green Generation (GG) 2020-2030 HALIEUTIS 2007-2020	Forests of Morocco 2020-2030 *Multiple Issues within the National Sustainable Development Strategy (2030) including green economy and biodiversity*	National Determined Contribution (2030) CC components included in: *Green generation* *Forests of Morocco* *National Sustainable Development Strategy 2030 including Issue 4 for National Climate Change*	National Programme for Supply, Drinking Water and Irrigation (NPSDWI) 2020-2027
Mauritania	National Food Security Strategy (NFSS) 2012-2015 and Vision 2030 National Rural Sector Development Strategy (NRSDS) Horizon 2013-2025	National Strategy for the Environment and Sustainable Development (NSESD) 2017-2021, Horizon 2030 National Wetland Conservation Strategy (NWCS) 2014	Updated National Determined Contribution (NDC) 2021-2030 Components included in: *NRSD Axis 4* *NLDP Axis 1* *NSEED Axes 2 and 3*	National Strategy for Sustainable Access to Water and Sanitation (NSSAWS) (2030) Components included in: *Integrated Water Resources*

	National Agricultural Development Plan (NADP) 2016-2025 National Livestock Development Plan (NLDP) 2018-2025			*Management (IWRM) approach* *NFSS Pillars 1 and 3* *NRSD Axes 2 and 4* *NWCS Axis 5*

Source: Compiled from individual country reports

Upon inspection of the main content and topics addressed in each of the policies per country in North Africa, the categorization was performed to allocate the strategies as either agricultural, environmental, climate change, or water-related. This task in itself emerged some observations worth mentioning. On one hand, certain countries were seen to have developed specific standalone strategies for each of these themes, such as Egypt and Tunisia. On another hand, it becomes clear that other countries, despite not clearly defining separate strategies, have indeed incorporated an interconnectedness of these themes together in one or more of their national strategies. This is especially true in topics related to climate change, water, and resource management. For this reason, the above table considers that strategies on biodiversity, desertification, reforestation, and wetlands fall under environmental policies. The integration of climate change for example and its general recognition in North Africa is clear and evident mainly due to the increasing water scarcity, desertification threats and degradation of land and natural resources. Egypt, Tunisia and Algeria are seen to have standalone strategies on climate change mitigation in addition to the National Determined Contribution commitments and measures to which the other countries have also committed to. Yet, climate change is mentioned and found interconnected in a multitude of other policy documents across the different countries whether in agricultural, environmental or water strategies. Tunisia intersects climate change in its NSET and NSAPB (environmental strategies), Algeria in its NWS (environmental strategy), Morocco in its Green Generation (agricultural strategy), Forests of Morocco (environmental strategy) and Development Strategy, and Mauritania in its NRSD, NLDP (agricultural strategies), and NSEED (environmental strategy). It is not surprising how host of the climate change adaptation measure intersecting in policies are seen to address mostly the topic of water, and mostly in management of the resource. For all countries, commitments to NDCs exist and normally tackle Greenhouse Gases (GHG) emissions. In Morocco's agricultural strategy, the Green Generation (2020-2030) for example, the term climate change despite not being explicitly used, the strategy does however touch on renewable green energy topics as solar and biomass.

On another hand, it becomes an interesting and pivotal part of the analysis to look into the understanding of each country for these themes and issues, and how each country translates them into action plans. Given that multiple countries are noticed to follow similar trajectories in their strategies and mention common terms in their orientations, it is important to investigate whether they are applied in similar approaches also. This transposition of strategies into action plans, programmes, or projects, provides a deeper insight on what constitutes priorities to serve the orientations and objectives listed by every country in this study. This analysis is provided in the next section of this report.

3.2.2. Main orientations and transversality of the selected public policy strategies

A deeper reading of the public policy strategies focused on identifying the main orientations and priorities as listed in the official documents. The main objective of this step was to identify common and/or specific orientations being officially announced and adopted between the countries. These are summarised in Table 12. It is however important to note that most of the relevant public policies touch on multiple intersections within the same strategy as noted previously. This is especially true to objectives and targets relating to the environmental and biodiversity preservation, management of natural resources, reduction of climate change impacts, and mainly water preservation.

Table 12: Main orientations and objectives of public policies in North Africa as mentioned in official strategy documents relating to agriculture, environment, climate change, and water.

Country	Main stated objectives of related public policy strategies
Agricultural strategies	
Egypt	*Sustainable Agricultural Development Strategy (SADS) 2020-2030* **Achieving national food security and improved nutrition** through "growth of the agricultural sector" and by improved efficiency in resources use and geographic comparative advantage through modernization and increase of food production (intensification of productivity and reclaimed/cultivated land). Main objectives are inclusive of provision of basic food needs, decreasing food imports while promoting agricultural competitiveness and exports, poverty eradication, **mitigation of climate change impacts**, and enhanced sustainable agriculture through management of natural resources with 'absolute priority' to the management of scarce **water resources** and their rational use/preservation mainly through **modernized irrigation** (sprinkler, drip) coupled with the increase in irrigated land surfaces.
Tunisia	*National Action Plan on Sustainable Production and Consumption Patterns in Tunisia Ten-Year Agri-Food Action Plan 2016-2025* **National food security as a main pillar**; with the ensuring **sustainable food chains** throughout product life cycle (for purposes of improved economic, social, and environmental performances), with the approach focusing on ensuring national food security, **rationalising use of natural resources, energy, and water** (reducing overexploitation) **along with land planning and improving soil conditions**, and encouraging **sustainable production and consumption** patterns (promoting adapted sourcing and distribution, with the addition of environmental consumer behaviour and consumption of labelled products). Other orientations cover the food security needs to be covered by increased production and export (production and added-value) with an element of food quality and safety vigilance.

Algeria	*Agricultural Strategy 2020-2024* Promotion of **green economy**, rational management of natural resources (mainly water issue through **irrigation measures** (drip and sprinkler) and adoption of renewable energy as an orientation of sustainable development), and resilient growth of the agricultural sector with the integration of economic **diversification** (the forest sector) and **resilience factor** through the introduction of hardy species (carob, argan, almond), academic partnership and green innovation mainly in organic fertilizers and pesticide development.
Morocco	*Green Generation (GG) 2020-2030 / HALIEUTIS 2007-2020* Incorporating two axes; **human (new generation of agriculture middle class, youth entrepreneurs, agricultural organisations and follow-up services/extension) and agricultural (agricultural sectors and value chains, efficient distribution, quality/innovation, and resilience/eco-efficient agriculture)**. Prioritizing agricultural development (and linked human elements) by actions at the **level of value and distribution chains** (modernization and rehabilitation of markets) with notions of quality and innovation along with sustainability and resilience of the sector through the preservation of natural resources (irrigation water management), transition to renewable energy, and improvement of soil conservation techniques. Also focuses on promoting **competitiveness** (social and economic growth) with increased production and export efforts aiming to double the Gross Domestic Product (GDP) and to double exports by value. Focus on the three axes for the fishery sector for the purpose of food security: sustainability (applying quotas, modernization, driver of growth, sharing of knowledge), performance (infrastructure/equipment development, port dedication, structuring and revitalizing internal wholesale and retail markets) and competitiveness (facilitated access to raw material, orienting manufacturers, creating 3 competitiveness clusters in the North, Centre and South of the country). Focuses on the promotion of socio-economic job creation (+80%), more than doubling of the fishery sector's GDP and increase in exports (160%) and national consumption (to 16kg/capita/year) with the preservation of maritime resources (5% to 95%).
Mauritania	*National Food Security Strategy (NFSS) 2012-2015 and Vision 2030 / National Rural Sector Development Strategy (NRSD) Horizon 2013-2025 / National Agricultural Development Plan (NADP) 2016-2025 / National Livestock Development Plan (NLDP) 2018-2025* Through four main strategies, to promote **food security (access to healthy foods)**, to develop the agricultural, livestock and rural sectors with aims mainly **to generate employment and employability, and sustainable management of natural resources** (water and pastures particularly the Senegal River, land and wetland management/protection). The strategies mention the promoting of food security through **land reform**, **protection of local production, financing policies** (for crop production, irrigation, and livestock), **added-value and food processing, capacity building and research**. Development is understood in four components: economic, (key sectors as

	agriculture and livestock, also new employment generating activities as tourism, ecology, and culture), human component (improved capacities for improved employability), environmental component (safeguarding, controlling, and developing natural resources), and institutional component (ensuring application and sustainability of strategies within Public-Private Partnerships). Promotion of agriculture and livestock revolving around intensification, diversification (irrigated and rainfed crops) and competitiveness (storage, equipment, marketing, enabling environment of the dairy sector, and capacity strengthening in technical, organizational, negotiation) with high growth potential (moving from subsistence agriculture to competitive livestock and crop production) to meet national needs with improvement of trade, sustainable management of natural resources, and improved quality of agricultural services (capacity building of public services and producers/organizations, financial products and insurances.
Environmental Strategies	
Egypt	*Biodiversity Strategy and Action Plan (EBSAP) 2015-2030 / National Action Plan to Combat Desertification (NAPCD)* **Reduction in the loss of biodiversity for a continued provision of ecosystem services** while ensuring the reduction in pressures on biodiversity, using biological resources sustainably, raising benefits of utilization of genetic resources, mainstreaming values and effectively implementing appropriate policies in a participatory approach; with policy action areas identified at the levels of conserving and restoring nature (terrestrial and aquatic biodiversity through secured network expansion, national monitoring methodology, conservation/ rehabilitation programs); **sustainable use of natural resources (including 'ecologically sustainable agricultural management' focused on fertilizers and pesticides**, protection zones against tourism effects, waste/ pollution management especially on wetlands and coastlines, land use management plans, increase water use efficiency in farming, good fishing practices), addressing the drivers of biodiversity loss; using biodiversity sustainably; mainstreaming and awareness-raising; and enhancing implementation and cooperation.
Tunisia	*National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Tunisia (NSAPB) 2018-2030 / National Strategy for Ecological Transition (NSET) 2035-2050 / National Action Programme to Combat Desertification (NAP-CD) 2018-2030* Through three strategies, priorities are noted for environmental protection, sustainable development, and **adaptation/resilience to climate change in multi socio-economic development** along with multi-sectoral prioritization of dignified living conditions, effective economic governance, and equitable distribution of national wealth, with food security as a strategic objective. **Conservation and sustainable use of biodiversity is linked with increasing resilience to climate change with socio-economic benefit for present and future generations**. The mainstreaming of biodiversity in other national strategies is prioritized mainly for land use decisions (compensation for biodiversity losses) along with

	a monitoring body for violations in the sector of agriculture, and a co-management of natural resources (encouraged public-private partnerships). Reducing pollution and pressures/threats on biodiversity include incentive measures, technical measures (training and guides at farm and landscape levels, reduction in fertilizer emissions and use of pesticides, conservation weeds, and biological control), climate integrations into agriculture strategies, restoration, and plans for mitigation/adaptation programs promoting research. Orientations also revolve around ensuring sustainability of the natural capital while improving efficiency of resources, presupposing the transformation at the level of both individuals and collective behaviour through an evolution of production and consumption patterns towards improved sustainability and circularity. Sustainable management of resources is linked to water (conservation, loss reduction non-conventional water resources), reduction in use of chemical pesticides, expanding protected areas, and rehabilitation of degraded soil. For oases ecosystems, it includes sustainable management of land and water for biodiversity preservation purposes and maintenance of genetic diversity.
Algeria	*National Biodiversity Strategy and Action Plan (NBSAP) 2016-2030 / Green Dam Rehabilitation Plan originally 1970 with vision 2023-2030 / National Wetlands Strategy (NWS) 2015-2030 /… in addition to legislation (No. 03-10 (2003) and 83-03 (1983))* **Legislation mentioning the protection of the environment and the rational management of natural resources within sustainable development aiming for improved food security**, promoting productivity and competitiveness while guaranteeing protection of the land, rational use of water for agricultural purposes and preservation of its production potential. Policies prioritize the conservation and restoration of natural capital, valuing biodiversity for the green economy (including fight against deforestation and climate change through reforestation efforts focusing on high economic value species and sustainable management of wetlands), adaptation of the institutional, policy and legislative framework, and development, sharing and valorisation of knowledge for inclusive sustainable development. Focus also found on countering the encroachment of the desert through the renewal of forest heritage (reforestation and particular attention to water and soil conservation).
Morocco	*Forests of Morocco 2020-2030 / Multiple Issues within the National Sustainable Development Strategy (2030) including green economy and biodiversity* Focus on halting deforestation and the recovery/restoration of the forestry sector with environmental and economic functions under a sustainable and wealth-creating management model based on five orientations: 1) territoriality (inclusive of the concept of 'inhabited users'), 2) sustainability (balance and regeneration capacities of the forest and its resources), 3) participatory approach (engaging forest 'users' in collective management), 4) productivity (mobilizing productive potential through private sector partnership), and 5) biodiversity (safeguarding of natural, biological, and genetic heritage). Measures include the introduction of a participatory approach for forests management with

	the organisation of the population in the form of civil society organisations (associations and cooperatives) and forest development organisations for sustainable management, private investments of large forest areas (focus on eucalyptus and pine) with a modernization aspect in nurseries with genetic preservation, whereas resilience equates to watershed management in priority basins and the opening of physical runways. The National Sustainable Development Strategy includes a global and transversal approach focusing on overall development in economic, social, environmental, and cultural issues (green and inclusive economy by 2030). Inclusive of seven issues of which 'green economy' (including encouraged investments in energy efficiency, public transport, sustainable agriculture, ecosystem protection, and soil preservation) in Issue 2, management and development of natural resources and strengthening of biodiversity conservation is in Issue 3 (mainly related to water supply and soil pressures), and accelerating the implementation of a national policy to combat climate change in Issue 4 (governance, fighting global warming, and climate financing, with a direct link to the measures stated in the National Climate Change Policy).
Mauritania	*National Strategy for the Environment and Sustainable Development (NSESD) 2017-2021, Horizon 2030 / National Wetland Conservation Strategy (NWCS) 2014* Slowing and reversing environmental degradation trends so that the development of natural resources contributes effectively to ensuring green and inclusive growth mainly through sustainable and resilient valuing of natural resources, and through the promotion of environmentally sound use of ecosystem services and natural resources with a strengthened prevention and management of pollution and anthropogenic threats (pollution and emissions). Within an objective of national sustainable development, includes the improving of living conditions and environment of local populations while ensuring sufficient natural resources for future generations through the conservation, restoration and sustainable use of wetlands and their associated biodiversity. Priority approaches based on wetland restoration (halting degradation and restoring ecological continuity), biodiversity conservation, environmental protection, and protection and sustainable use of wetland ecosystems (including farming practices: avoiding land clearing, promoting products from preservation processes, encouraging intensive farming/breeding).
Climate Change Coping Strategies	
Egypt	*National Climate Change Strategy (NCCS) 2050 / National Determined Contribution (2030) / CC components included in SADS and EBSAP strategic goal 5* Five goals consolidated in one reference document ensuring the integration of climate change dimension in general inter-sectoral planning based on 1) achieving sustainable economic growth and **low emissions** (increasing share of renewable energy: large-scale as wind farms and small-scale as rooftop photovoltaic systems; reducing emissions, sustainable consumption and production for reduced GHG emissions), 2) enhancing

	adaptive capacity and resilience and alleviating associated negative impacts (citizen health protection: early warning system, preventive services; **ecosystem preservation**: adaptive capacity, reserves and endemic species; **preservation of resources mainly through waste/water use reduction and efficiency including water collection and irrigation efficiency, wastewater treatment, non-conventional water resources, soil fertility maintenance for agricultural purposes, cultivating tolerant varieties and hybrids, allocating new lands to increase agricultural areas, afforestation), 3) enhancing action governance** (multiplicity of stakeholders and encouraging improved ranking for attractivity of climate investments), 4) enhancing **financing infrastructure** (promoting green banking/credits, private sector engagement including tax facilitations), and 5) enhancing scientific research, technology transfer, knowledge management and awareness to combat climate change (phenomena study, encouraging integration in university programs, increased research funding, international research cooperation, national databasing and coordination, citizen awareness raising, etc).
Tunisia	*National Determined Contribution (2030) / CC components included in: Axis 2 of the NSET strategy includes adaptation to CC. / Objective 3.1 and Action priority 4 of the NSAPB. / Priority orientation 2 of the NAP-CD. / Two strategies exist: National Low-Carbon Strategy (NLCS) (2022) and the National Strategy for Climate-Resilient Development (NSCRD) (2022) that link to agriculture.* Two strategies exist including the National Low-Carbon Strategy (NLCS) (2022) and the National Strategy for Climate-Resilient Development (NSCRD) (2022) that link to the agricultural sector along with the NDC (2021-2030). The three environmental strategies clearly indicate climate change priorities and measures. Axis 2 of the NSET refers to the NDC in terms of carbon neutrality, energy strategy (2035), **adaptation and resilience in agriculture**, health and coastal areas (with reference to the Integrated Coastal Zone Management (2020), **reforestation and fire protection actions**, establishing a national climate early warning system, and a carrying a model action of the 'Kerkennah' island system model for adaptation and climate resilience. The NSAPB includes an objective 3.1 for actions on developing and improving knowledge on ecosystem biodiversity conservation (integrated research, analysis of genetic diversity, specialized training, observation network establishment, etc.), and **action priority 4 on the mentioning of the concepts of agroecology** (typological identification of agro-ecological zones, incentives measures, awareness-raising, farmer guides, research promotion on soil inputs, GHG reduction incentives, land restoration, etc.). **Priority orientation 2 of the NAP-CD links resilience of ecosystems and agrosystems to climate change mainly through adaptations and effective policy geared on enhancing security hydraulics**.
Algeria	*National Determined Contribution (2030) / National Climate Plan (2030) /CC components included in the NWS* NDC contributions exist along with a National Climate Plan although not analysed in this document. Yet, it is evident that climate change threats are the driver for a change in the modes of governance relating to irrigation water and management of water resources and in efforts to decrease desertification, erosion and degradation of cropland. An example is

	provided in the country report around the emergency program for the provision of drinking water supply to urban areas focusing on seawater desalination and an increase in the number of desalination plants in response to the growing demand on water needs. Drip irrigation initiatives are also described as climate-smart water-related infrastructural solutions that improve use and resilience. An example of the Kser Tafiliet ecologival village in the Wilaya of Ghardaia which was inaugurated in 2004 as the first ecological city in the Algerian desert is provided as a representation of social, urban and ecological organization and manifestation of climate change adaptation with the preservation of an oasis microclimate.
Morocco	*National Determined Contribution (2030) / CC components included in: Green Generation, Forests of Morocco / National Sustainable Development Strategy 2030 including Issue 4 for National Climate Change* Other than the NDC contributions, the National Climate Change Policy provides an operational framework for medium- and long-term climate resilient growth (improving climate governance, including territories in fight against global warming, and seizing opportunities of climate finance). Climate change components are also highlighted in the Green Generation, Forests of Morocco and National Sustainable Development strategies. Although the GG strategy does not use the term “climate change” explicitly, its programs revolve around revitalizing employment and entrepreneurship in agricultural and para-agricultural sectors with initiatives incorporating organic production practices, solidarity/collective projects, pastoral rehabilitation, conservation agriculture, reforestation efforts, and oasis water adaptive capacity as adaptation measures to climate change (with improved quality and value). Adaptations are also clear around the irrigation sector including seawater desalination programs with elements of digitalization of the agricultural sector.
Mauritania	*Updated National Determined Contribution (NDC) 2021-2030 / Components included in: NRSD Axis 4, NLDP Axis 1, NSEED Axes 2 and 3* The NDC includes an inter-disciplinary and inter-sectoral approach aiming for 11% reduction in Greenhouse Gases (GHG) emissions by 2023 (green curve) with mitigations prioritizing the clean energy and forestry-focused potential, and with the broadening of adaptations to different areas including: **protection and conservation of ecosystems including wetlands, sustainable rangeland management, biodiversity conservation, fisheries and aquaculture**, housing and urban planning, agriculture and food security including genetic improvement, health, water, coastal management, prevention of extreme weather events, infrastructure and education. Climate change components also exist in agricultural and environmental strategies such as the NRSD, NLDP and the NSEED. Their relevant priorities include control of agricultural and **livestock resources**, support to production and management of natural resources such as in pastures and traditional (small-scale family) livestock farming, restoration efforts and physical protection of the coastline and marine environment.

Water-related Strategies	
Egypt	*National Water Resources Plan (NWRP) 2017-2037* Mitigating water scarcity through the dealing with water quality, conservation, resources development, and raising awareness for rational water consumption. Prioritized pillars include water quality (water treatment: sewage, industrial, wastewater and groundwater; pollution control, and solid waste management), water conservation also linked to the agricultural sector (water rationalization with reduced water-needing crops, increasing irrigation efficiency and water management, aggregation of land tenures, and public water consumption), and development of water resources (desalination plants, media).
Tunisia	*Water 2050 Strategy* Applying progressive restrictions on mobilized water resources while transforming the sources of main water use from surface water into 'water saving' and groundwater (transforming volatile surface water into groundwater by means of artificial groundwater recharge) while optimizing the use of the superior quality 'waters of the far north' intro a drinking source instead of its mixing with inferior water quality and investing efforts to 'return it to the original level of quality'. Includes axes on drinking water desalination and renewable energy, integrated water resources management and food security, water quality saving and safeguarding ecosystems, and water and territories for inclusive and sustainable development.
Algeria	Even if there is **no standalone policy** on a water strategy, **there is a clear mentioning of food sovereignty as a priority driving an expansion of irrigates surface areas to achieve an increase in agricultural production especially in key cultures such as cereals, dairy, and potatoes**. Such approaches are further directly pushed as a result of the growing threats of climate change. This vision encompasses of **a mobilization of 83% from groundwater sources**, 8% from dams and reservoirs for large-scale irrigation activities, 7% from wastewater reuse, and 7% from watercourses.
Morocco	*National Programme for Supply, Drinking Water and Irrigation (NPSDWI) 2020-2027* Focus on strengthening the development of water supply through the construction of dams and the transfer of water between the various hydraulic systems. Mentions of the promotion of non-conventional waters (seawater desalination and the reuse of treated wastewater), water demand management (water saving approach) and a consequent enhancing of the water resources mobilized for irrigation, drinking and industrial water, along with the preservation and protection of water resources and ecosystems, and management of extreme weather events (floods and droughts).
Mauritania	*National Strategy for Sustainable Access to Water and Sanitation (NSSAWS) (2030) / Components included in: Integrated Water Resources Management (IWRM) approach, NFSS Pillars 1 and 3, NRSD Axes 2 and 4, NWCS Axis 5*

	A water strategy exists although not analysed in this report, the National Strategy for Sustainable Access to Water and Sanitation (NSSAWS) (2030), noting that its Axis 3 is inclusive of cross-sections with agriculture and livestock ("hydro-agricultural" and "hydro-pastoral" development components that include rehabilitation of surface developments and dams, using surface water sources for irrigation and pastoral water points). Other intersections on water are also found in agricultural and environmental strategies with orientations geared around water management/protection/control, improve access to drinking water, and financing mechanisms for oasis, rainwater, agro-pastoral, and irrigated production systems.

Source: Compiled from individual country reports

As it becomes clearly evident, certain similar observations emerge highlight common priorities and approaches adopted by countries in North Africa in addressing key socio-economic and environmental challenges. Multiple common orientations emerge around national food security, sustainable development and resource management, climate change resilience, and multi-sectoral approaches. Yet, it also becomes clear that similar terminologies differ in their interpretation between the different countries.

Most commonly is the issue of securing national food security. All studied countries prioritize ensuring national food security through their agricultural strategies especially under a context threatened by climate change, desertification, and land degradation with progressively limited access to water resources. Food security is included as a priority in agricultural strategies such as in Egypt, Tunisia, Morocco, and Mauritania, but is still intersected in other sectoral policies as well. An example of that includes Tunisia's environmental strategy against desertification (NAP-CD). Under such national strategies, countries utilize certain repetitive measures in their policy documents involving mainly rationalizing and managing the use of natural resources while promoting sustainable practices, but yet call for an increase in productivity, and developed exports to decrease dependency on food imports within a spirit of both sustainability and efficiency being used together. In fact, the issue of food security directly relates to enhancing food independency, one of the major challenges faced commonly by countries in North Africa, which frequently constitutes encouraging the increase of agricultural production to meet local needs and decrease dependence on food imports especially in basic food needs. What is also evident is that approaching the need to improve food independency moves in parallel with the encouragement of environmentally sound and sustainable practices in all countries analysed in North Africa. One of the most repetitive measures in face of uncertainty is 'sustainable management of natural resources' which effectively revolves in most cases around water-related issues, including its scarcity, need for preservation or rehabilitation, reduction in use with increased efficiency, and/or the securing alternative sources such as wastewater treatment and seawater desalination. In any case, water is a common denominator underlying the majority of public policies in North Africa and is seen as a driver behind climate change adaptations, food security, environmental sustainability, resilience and overall human development.

Yet, certain diverging measures differ each country's approaches. In Egypt for example, food security measures prioritize the increase in agricultural production, reducing food imports, and promoting agricultural competitiveness through modernization and efficient resource use of mainly water. Similar approaches in

encouraging growth to meet food security and development objectives are also noted in Algeria and Mauritania. Algeria focuses on promoting a green economy, managing natural resources sustainably, and achieving resilient growth in the agricultural sector to ensure food security. Mauritania also calls for a high growth potential cultivation and additionally aims to aims to promote food security through land reform, financing policies, and sustainable management of natural resources to improve access to healthy foods. Interestingly, Tunisia and Morocco both approached this priority from a perspective of food chains and distribution chains. Tunisia mentions the improving of production and, interestingly, the consumption patterns to enhance food security along with the emphasizing on sustainable food chains (especially for olive oil) and the introduction of notion of sanitary conditions of food both in the dimensions of quality and safety. Morocco prioritizes modernization, improving distribution chains, and promoting sustainable and resilient agriculture to enhance food security with the notion of competitivity in products such as argan and fishery.

The encouraging of productivity increase and growth is explicitly prioritized in countries such as Egypt, Tunisia and Mauritania. In Tunisia, this increase in productivity in support of meeting food security objectives is mentioned in the form of developed yield, and its relation to the needed improvements in soil fertility. On another hand, a clear emphasis on increasing agricultural production by means of intensification is stated directly in the agricultural policy documents of Egypt and Mauritania therefore highlighting intensive practices as a main objective. In Egypt for example, the agricultural strategy SADS (2020-2030) clearly emphasizes on the growth of the sector formulating the vision as "*Inclusive economic and social development based on fast, sustainable and inclusive growth of agricultural sector […]"*. For Egypt, the means to increase in productivity are seen to mainly revolve around efforts to expand irrigated surfaces of land through the encouraging of the application of drip irrigation under the frame of managing scares water resources. The call to increase cultivated spaces is also included in Egypt's climate change strategy NCCS (2050) which encourages the use of cultivating tolerant varieties as well as hybrids and for allocating new agricultural lands. As for Mauritania, 'high growth potential' is used in the objectives of two of the country's agricultural strategy documents mainly to meet food security needs and generation of employment. In fact, Mauritanian policies recognise that local populations are dependent on subsistence agriculture which is not seen to sustainably reduce food insecurity and poverty. This is why one of its prioritizing of cultivation with high growth potential serves to shift from subsistence agriculture to competitive livestock and crop production. The objective of Axis 2 (Promotion of agriculture) of Mauritania's NRSD (2013-2025) states "*Promotion of competitive agriculture through the promotion and development of crop sectors with high growth potential.*", and in the objective of the NADP (2016-2025) as "*promote modern, competitive and sustainable agriculture through the development of plant sectors with high growth potential*". In addition, intensification is also mentioned in Mauritania's NRSD Axis 1 (Promotion of the livestock sector) as "*Promotion of an intensive and competitive livestock sector [...] and the enhancement of extensive livestock farming through the sustainable management of natural resources*.". Morocco on another hand also prioritizes employment elements thus geared towards the inclusion and integration of the youth in agriculture, stating the "emerging of a new class of young farmers." In the country's Green Generation (2020-2030). In fact, this strategy is divided in two main priority axes: the human element, and the agricultural development, with the human axis focusing on the emergence of a new agricultural generation and young entrepreneurs supported by encouraged new agricultural organisations and accompanying mechanisms. On another note, an accent on increased exports as a priority objective is highlighted in the agricultural strategies of Egypt, Tunisia and is especially

significant in the case of Morocco. Morocco's Green Generation policy (2020-2030) aims for the doubling in the country's exports and GDP by 2030, and the HALIEUTIS (2007-2020) also aimed for 160% increase in the export of fishery products thus highlighting the important position given to developed product value as well as volume exported.

Environmental sustainability and socio-economic development are raised across various strategies and around all the studied countries in North Africa with a strong emphasis whether it's in agricultural, environmental conservation, or climate change coping strategies. This objective revolves mostly around the promotion of green economies, sustainable resource management, and resilience to environmental challenges. Directly linked to this objective comes the sustainable management of natural resources as a recurring theme in the analysed public policies, with water resources being the major component. Many of the strategies prioritize the importance of conserving and preserving natural resources especially water, but also soil, land, and biodiversity. They also emphasize rational use of these resources not only as climate change mitigation measures (in addition to those related to GHG emissions which are prioritized in countries' NDC contributions), developing resilience and conservation of the environment and human well-being but also in support of economic growth.

The main perspective of environmental sustainability as in "ecologically sustainable agricultural management" in Egypt is seen again from the perspective of increased water efficiency through modernized irrigation (meaning drip irrigation) in farming with the objective of increasing irrigated surfaces, but also includes elements of fertilizers and pesticides. In Tunisia, the concept revolves around reducing biodiversity loss and conserving natural resources, mainly water, but focuses on the preservation and rehabilitation of soils which are in need of improved fertility. In fact, the Tunisian combating desertification strategy NAP-CD (2018-2030) dedicates a specific Axis 3 that focuses on the restoration of agricultural land and ecosystems (which includes agroecology) and which prioritizes these actions for the improvement of soil fertility thus re-establishing the importance of soil restoration which is encouraged mostly through organic amendment. Interestingly, Tunisia and also Morocco introduce a component related to genetics in relation to environmental sustainability. Tunisia mobilizes the development of genetic resources and analysis of genetic diversity of local species and their vulnerability to climate change in its NSAPB (2018-2030) in similar efforts to those that called for by the action plan for the sustainable development strategy for oases in Tunisia. Morocco similarly mentions the importance of preserving the genetic character through modernization efforts of forestry professions (such as nurseries) in its Forests of Morocco strategy (2020-2030). In fact, Morocco's vision around forests prioritizes halting deforestation, restoring the forestry sector, and promoting sustainable management of natural resources (also in relation to water resources as is common with all countries in North Africa) with an objective of ensuring green and inclusive growth. In fact, the country's strategies include a component of encouraging private sector partnerships to mobilize the "productive potential" of forests for example through encouraged investments. The objective of growth emerging from the understanding of environmental sustainability is also noticed in the case of Algeria and Mauritania. In Algeria, a legislative law exists for the protection of the environment but also similarly calls for rational management of natural resources and conservation and restoration of ecosystems for green and inclusive growth. It's strategies also focusing on diversifying the economy through the forest sector and approaching resilience via the development of hardy and economically valuable species such as carob, argan, almond, pistachio and prickly pear. In Mauritania, policies aim to slow and reverse environmental degradation, promote sustainable use of ecosystem services, and protect natural resources for growth.

When it comes to climate change, there is a general recognition between the countries of North Africa on the importance of addressing climate change through adaptation measures (which is generally understood as water conservation and ecosystem preservation) and mitigation efforts (commonly including the adoption of renewable energy and reductions in emissions). Other than having all countries with NDCs, the integration of climate change adaptations and mitigations have similar and sometimes slightly different approaches whether being in standalone policies or integration in other sectoral strategies. For Egypt for example, even if the country's standalone policy dedicates efforts calling on the integration of climate change dimensions into planning, enhancing adaptive capacity (with for example the introduction of tolerant varieties and hybrids), and promoting sustainable economic growth with low emissions, the overall objective still remains modelled for the allocation of new agricultural lands. Yet, the strategy includes a component of an early warning system when it comes to the protection of citizen health. Such early warning systems are also seen included in the policies of Tunisia and Algeria. Tunisia for example directly links climate change measures to multiple sectors as agriculture, health and coastal areas (also similarly approached by Mauritania) and with measures of reforestation and fire protection inclusive of the early warning system approach. Tunisia's NSET (2036-2050) Axis 2 provides an example flagship model project on adaptation and climate resilience consisting of "Kerkennah: island system model for adaptation to climate change and ecological transition". For Algeria, the approach relates to establishing a biodiversity observatory, with strategies on climate change cross-cutting with decreasing desertification, erosion and the degradation of arable land with the calling on needs for climate-smart water infrastructural solutions.

There is also a clear **recognition of the interconnectedness of various sectors and the need for a multi-sectoral approach to address complex challenges like food security, environmental conservation, and climate change**. Strategies often involve collaboration across different government departments, as well as engagement with stakeholders from civil society and the private sector in efforts **to develop participatory governance**. Despite it being a common discourse, Tunisia and Morocco were the countries that clearly depicted **the inclusion of local-scale actors**. In Tunisia for example, the agricultural strategy mentions adopting both top-down and bottom-up approaches in its initiatives to involve the multiplicity of actors in planning and decision-making. Tunisia also states the following of a territorial development approach in several of its strategies such as the NAP-CD and NSET. Morocco similarly mentions an element of 'territoriality' especially in its forests considered as inclusive spaces "inhabited by users" and therefore highlighting the participatory management approach envisioned to engage these users along with civil society organisations.

Finally, it is important to note that many if not all studied countries have in fact a **strong element of international cooperation to varying extent especially in implemented programs, research and transfer of knowledge**. In Egypt, Tunisia, and Morocco, policy strategies clearly mention engaging in international cooperation. For Egypt, the implementation of multiple adopted strategies was seen to mobilize the international actors whether at the funding or implementation aspect with NGOs. Egypt's agricultural strategy SADS (2020-2030) was developed as a result of extensive consultations with many stakeholders and actors including the international development community. In its water strategy NWRP (2017-2037), it is mentioned that the strategy itself involves various international partners in addition to nine ministries. International institutions participating in projects and funding related to agroecology in Egypt include, as a non-exhaustive list of examples, the World Bank (WB), FAO, USAID, CGIAR, IFPRI, GIZ, and others. In the case of Tunisia, the introduction of agroecology

in its policies is also acknowledged through collaboration with international community programs along with collaborations in its combating desertification and water strategies (such as with the UNDP and the GEF). Similarly, Morocco also mentions the introduction of agroecological practices programs aiming for improved resilience of agricultural systems led by international cooperation efforts.

Box 8: Main observations on the orientations of the analysed public policies

All studied countries exhibit similar priorities in the orientation of their national public policies. They mainly include the issue of national food security and decrease of food dependence while focusing on increased agricultural productivity, reduced imports (and increased export in the cases of Egypt, Tunisia and Morocco), coupled with sustainable resource management and efficiency. Although the various strategies utilize similar terms, countries show a divergence in the way that these terms are perceived. In Egypt, food security is approach from an angle of production increase and efficient resource (water) use, while in Algeria, it is approached from a reliance on water assets / green growth, and in Mauritania, is approached from a focus on the livestock sector and main crops (rice and sugar cane). Yet, within a common context of environmental challenges and risk of limited natural resources, all countries also report an important emphasis on water conservation measures. This is also true in the term of 'sustainability' and 'sustainable resource management'. While emphasizing the importance of rationalizing water and adopting water-saving approaches, countries like Egypt focuses on modernizing agriculture for the purpose of expanding irrigated land to boost production, whereas Mauritania promotes high-growth potential cultivation and land reform. Tunisia and Morocco prioritize food and distribution chains, with Tunisia focusing on production and consumption patterns along with soil fertility, and Morocco on modernization of sustainable agriculture and the inclusion of a new young generation in the agri-food sector.

Environmental sustainability goals are prevalent in the formulation of the different strategies, emphasizing green economies, sustainable resource management, and resilience to environmental challenges. This often includes water and soil conservation, biodiversity preservation, and promoting green growth. Water management is a critical focus, underpinning many policies related to climate adaptation, food security, and environmental sustainability.

In addition to having all countries have NDC commitments, climate change measures are integrated within their strategies rather than standalone policies (although they exist in some cases as in Egypt), focusing on adaptation and mitigation, with some adopting early warning systems and cross-sectoral approaches.

A multi-sectoral approach involving collaboration across government departments and engagement with civil society and private sector stakeholders is also commonly advocated. Tunisia and Morocco notably highlight the inclusion of local actors and participatory governance. Yet, despite having similar emphasis on the objectives formulated in official strategy documents, the question remains whether the application of such objectives is transferred clearly in structured in effective and applicable programs, which is not always evident when attempting to analyse programs as per their link to a specific strategy.

Finally, international cooperation plays a significant role in the introduction of agroecological concepts and the stimulation of relevant projects and skills / knowledge building. This is especially evident with countries

engaging in international programs, research, and knowledge transfer to implement their strategies. Egypt, Tunisia, and Morocco, in particular, have extensive international partnerships to support their policy objectives.

3.3. Implementation of National Agricultural Strategies and Agroecology

3.3.1. From strategies to policies, an insight on empirical action

This part aims at identifying main domains of investments and action in the frames of the national agricultural policies, focusing on most visible concrete measures that come out from national country reports.

In Mauritania, the intensification of agricultural production will be achieved through the strengthening and improvement of access to production factors (land, water, hydro-agricultural facilities, equipment, seeds and other inputs, credits, etc.) as well as through the improvement and adoption of efficient technical itineraries. Diversification will focus on the cultivation of crop speculations other than rice and traditional cereals, particularly wheat and horticultural crops in the off-season.

1 - Extension of agricultural and irrigated land (Algeria, Egypt, Mauritania and Morocco) through major public investments and access to new lands.

In their quest for food security, countries continue to develop major agricultural expansion projects.

National budgets are focused on the functioning of administrations and on developments: the construction and maintenance of these major infrastructures. In all countries, private investors and operators therefore play an essential role in these policies. The support of international organizations and international cooperation should be highlighted, depending on the case.

Programs for access to new land resources target both large investors and smaller producers.

In *Algeria*, for example, it is planned in the 2020-2024 five-year plan to reserve 400,000 ha for private investors who wish to develop more than 100 ha. Small producers are as much targeted by subsidized credits as large investors. These investments concern agriculture and livestock farming, but also the agri-food sector. Precision and digital agriculture is observed among large investors and the Ettahadi credit allows the acquisition of available technologies in this direction. However, there are no statistics to determine its extent.

In *Egypt*, the larger part of the new lands, covering more than 1 million ha, is newly reclaimed and cultivated in the desert with sandy soil that is poor in organic matter, thus need more chemical fertilizers to compensate. In the context of the government efforts to increase food production, it has recently launched four mega projects for reclamation of an area of about 1.5 million ha in the desert, or about 38% of the current cultivated area, which will add to the existing pressures on water resources. More than three quarters of this area is planned to be irrigated by triple-treated drainage water taken from the flood irrigation system in the Delta Region. In the long-run, these projects would, most probably, lead to adverse environmental impacts particularly as to soil and water quality and biodiversity. The context of the new lands looks poor in terms of agroecology content (Egypt country report).

In *Morocco*, this policy of access to land passes jointly through a progressive privatization of collective lands "usable for agriculture" (those potentially irrigable), and through consolidation actions to limit the fragmentation of land (inheritance laws).

In *Mauritania*, the total developed area is 63,070 ha in 2015, of which 73% are functional areas and 27% non-functional and/or abandoned. To this area is added 4,600 ha under rehabilitation. These areas are cultivated mainly in rice, wheat and sugar cane. To achieve the food security objectives of the agricultural strategy and increase horticultural production to cover 32% of needs for onions, 8% for potatoes and 63% of needs for other products in the sector. By 2025, it is necessary to act on increasing cultivated areas and improving yields (modernization of production systems) in order to exploit in 2025 approximately 8,771 ha including 2,771 ha existing and 6,001 ha of new developments, corresponding to a gross area estimated at 7501 ha (Mauritania country report). These extensions in Mauritania are oriented exclusively for national consumption. The extension and operation of developments face certain constraints including the complexity of traditional land tenure, the cumbersome nature of land regularization procedures and the partial exploitation of land already allocated for agricultural use.

2 – The permanence of the intensification model based on chemical inputs ….

These agricultural extensions are accompanied by technical guidelines which aim to intensify production through the use of fertilizers in particular and synthetic products, as well as to save scarce water. The risk of a drop in production associated with the risk of greater impoverishment of the majority of producers and a major rural crisis is sufficient to discourage changes in the absence of convincing alternative operational models on a large scale. On the contrary, recent climate crises have led all States to continue the policy of subsidizing inputs in all countries (national country reports), particularly fertilizers, of which several countries ensure local production.

Regarding fertilizers, *Algeria*, a producer of fertilizers using locally available raw materials, plans to increase the fertilized area, particularly for cereals, by removing certain restrictions and offering 20% subsidies to farmers for the acquisition of fertilizers (Algeria country report). The State has even decided to support fertilizer prices for the 2022-2023 crop year by 50%. This fertilizer pricing policy, which expresses support for the intensification of agriculture, illustrates an insensitivity to the climate and the environment that hinders the spread of agro-ecological practices in the sector.

In *Egypt*, nitrogenous fertilizers are provided to farmers by government at a subsidized price of 50% of the real price. Specific quantities are determined for different crops per area unit (fed), ranging between 3-8 sacks depending on the type of crop. There are three types of nitrogen fertilizers: urea (46.5% nitrogen), ammonia sulphate (15%), and ammonium nitrate (Egypt country report).

In *Tunisia*, the explosion in the prices of inputs, especially those of nitrogen fertilizers whose prices have tripled since January 2022 weighs heavily on agricultural operations and the State intervenes in setting the price of certain fertilizers produced locally (fertilizers phosphates and nitrate) promoting their use (Tunisia country report).

In *Morocco*, for the 2023-2024 campaign, concerning fertilizers, the market will be supplied with 600,000 tonnes of phosphate fertilizers, at the same price of the previous campaign. For nitrogen fertilizers, which are entirely

imported, the supply of the national market in sufficient quantities for approximately 500,000 tonnes at subsidized prices to the tune of 2.2 billion dirhams (200 million euros) to maintain prices at levels accessible to farmers throughout the national territory (site of the Moroccan Ministry of Agriculture).

In *Mauritania*, in July 2023, during communication in the Council of Ministers No. 23 relating to the 2023-2024 agricultural campaign, the Minister of Agriculture mentioned, i) the provision of hybrid seeds to producers, ii) the granting of a subsidy for market gardening fertilizers and herbicides, iii) agricultural mechanization with the acquisition of power tillers, tractors, mini-tractors and mowers (Mauritania country report). The question arises differently in this context where the majority of producers have little or no access to inputs in general, unlike the situation which prevails in other countries.

3 –The rise and predominance of water efficiency policies

Aware of the proven risks of water shortages for agriculture and domestic consumption, all countries have massively adopted measures in favour of transformation, mainly the modernization of irrigation equipment to increase water savings.

In *Algeria*, the promotion of water-saving irrigation equipment mainly concerns drip, but also sprinkling and it has been programmed in the 2020-2024 five-year plan, the reconversion of 150,000 ha towards these methods of water-saving irrigation systems from gravity (Algeria country report). Furthermore, a program to promote start-ups for the development of innovative methods of controlling irrigation with innovative technologies is mentioned in the roadmap of the 2020-2024 five-year plan.

In *Tunisia*, the National Irrigation Water Saving Program (PNEE) made it possible, until 2018, to equip approximately 405,000 ha of irrigable area out of a total of 405,000 ha of plot water saving means. planned for 450,000 ha. The objective for 2040-2050 is to equip 99% of irrigated areas with water-saving equipment (Tunisia country report).

In Egypt, The Action Plan of SADS is targeting the increase of the proportion of lands irrigated with modernized irrigation methods (modernized surface, sprinkler, drip) to around 31.7% by 2030, in addition to increasing the efficiency of field irrigation for 0.92 million ha (2.2 million feddan) in the New Valley and Delta regions from 50% (currently) to 100% in 2030. The eventual investments in the National Water Resource Plan, NWRP is planned to be EGP 900 billion (17 551 490 euros). The Ministry of Water Resources and Irrigation contribute EGP 240 billion (27%) to the NWRP (Egypt country report).

In *Morocco*, the promotion of micro-irrigation has been accompanied by technical advice on irrigation practices, crop selection and strengthening links with agribusiness and export markets. The expected results were water savings of 30 to 50% (1 billion m3 per year).

In *Mauritania*, water-saving irrigation techniques (drip systems) are still very little disseminated, and are targeted by the implementation of the national agricultural strategy, with the support of international partners in an integrated water resources management (IWRM) framework.

These global trends offer little resonance with the principles of agroecology, despite water recycling and its economy as priority concerns in policies. It should be noted that these actions on improving water management are present in all the other strategies identified, particularly with regard to plans to combat climate change,

desertification and rural development. Finally, these trends show an approach, when we talk about agroecology, mainly focused on the search for precision agriculture.

4 – Seed Policies

Seed policies are shared by all countries. Priority is placed on the national production and distribution of certified seeds, adapted to the different agroecological zones of the countries, to irrigation conditions and resistant to droughts. Countries have imposed, through their policies for several decades, the obligation to use certified seeds for producers, and tolerate or turn a blind eye to the use of self-produced local seeds. Their objective is to drive the rate of use of certified seeds to 100%. These seeds are part of technical packages which integrate inputs as well as certain equipment including irrigation equipment.

Given the recent inflation in seed prices, countries have developed different forms of financial support to promote supplies to producers.

5 – Crop diversification and organic agriculture, between food security and high value-added products

Crop diversification is part of agricultural strategies; it mainly concerns, depending on the country, strategic crops for national demand on the one hand, and strategic export crops on the other. A final cross-country axis concerns the promotion of crops that consume less water and are more resistant to drought.

In *Egypt*, under the implementation of the Economic Reform and Structural Adjustment Program (ERSAP) and the liberalization of the agricultural sector starting in the late Eighties, cotton exports have been gradually waived in favour of cereal production. Also, in the same direction rice exports has been banned by the government and area of rice, being water intensive crop, has been limited to almost half of the regular area, starting 2016 due to increasing water scarcity. In the actual period, the above MALR extension activities, particularly the National Extension Campaigns, concentrate on the so called “strategic crops” which are mostly related to food security including wheat, maize, rice, oilseed crops and sugar crops.

Algeria has decided to prioritize food sovereignty by aiming for a significant increase in national agricultural production, particularly in key sectors such as cereals, dairy production and potato cultivation. Regarding organic farming, the specific action mentioned is the strengthening of the regulatory framework governing organic farming.

In *Tunisia*, the Ministry of Agriculture must also face the major and urgent challenge of food security and has put in place urgent and short-term programs aimed at achieving self-sufficiency in durum wheat, red meat and milk in 2025, the increase in yields of certain irrigated crops (tomato, potato) and the increase in olive oil production. The actions necessary to achieve these objectives involve, for example, the continuation of wheat monoculture and the expansion of reserved irrigated areas despite limited and non-renewable water resources (Tunisia country report).

The Tunisian state has also put in place measures to encourage operators to convert to organic farming (Tunisia country reoprt). Among these measures, we can cite the suspension of customs duties and VAT on certain inputs specific to organic farming as well as 50% subsidies on:

- The cost of materials relating to equipment and tools specific to organic farming (with a ceiling of 500 thousand dinars),
- The cost of control and certification for organic farming,
- The costs of analysis, registration and testing of inputs specific to organic farming (ONAGRI, 2018).

In 2023, investments in organic production amounted to 10.2 M TND, with subsidies of 3.4 M TND (APIA, 2023). By 2030, the Tunisian State plans to strengthen the diversification of products from organic farming by encouraging the production of carob, vegetables, products from the prickly pear value chain and delicatessen products and essential oils which, year after year, position themselves on international markets (United Nations Tunisia, 2022).

Box 9: Incentives for organic production in Tunisia

For concrete measures, regarding the acquisition of equipment, the sector is exempt from VAT for locally manufactured equipment. It is also exempt from customs fees and VAT for imported equipment that does not have similar products manufactured locally. Concerning investment bonuses and incentives, 50 to 60% of investment costs are approved in the agricultural sector for the investment of different equipment to improve productivity, such as:

- The equipment necessary for saving irrigation water, improving its quality and controlling irrigation and fertilization techniques,
- The specific equipment, instruments and means necessary for production in accordance with the organic production method,
- Design equipment: computer-aided design and computer-aided drawing (CAO/DAO) station,
- Computer-aided production management and computer-aided maintenance management station (GPAO/GMAO),
- The specific equipment, instruments and means necessary for the production of compost and valorization of plant, animal and organic by-products, acquisition of precision field equipment and materials for the rationalization of the use of agricultural inputs and quality control.

Source: Inès Zouari, Tunisia Country Report

In *Morocco*, the Green Generation policy (GG) has consolidated the idea of building a resilient socio-agricultural fabric by being part of the generalization of social protection and by continuing to promote subsidized agricultural insurance for the benefit of cereals, legumes and tree crops. The GG also placed emphasis on entrepreneurship by playing synergy with other State programs which encourage agricultural investment through subsidized interest rates, loan guarantees and support for the design and start-up of projects. These incentives notably aimed at reconversion towards high added value crops, agricultural intensification (irrigation, equipment, selected seeds, fertilization, machinery, etc.), the promotion of niche products, and those in organic farming and the development of packaging and agro-industrial processing units. Recently, they are encouraging the adoption of crops that offer an interesting eco-economic return such as the carob tree, replacing the avocado tree. Among the supported sectors, we can highlight the argan tree, the organic sector, saffron (Morocco country report).

These sectors open up prospects for the development of agroecology, with an export perspective or for wealthy consumers.

In *Mauritania*, the country's food self-sufficiency in basic foodstuffs remains a major objective on which all the department's efforts are focused. To achieve this objective, emphasis will be placed on an approach focused on the extension of developments and the improvement of productivity through the concentration of efforts in the future, notably through financing and agricultural insurance. This axis is of capital importance for the development of the agricultural sector, particularly for the promising sectors (rice, market gardening and wheat). In this context, the department is launching a study which should propose a suitable financing and insurance system. In addition, Mauritania is currently targeting production of approximately 24,982 tonnes of onions, more than 3,259 tonnes of potatoes and 118,008 tonnes of various market garden products to secure its national supply. The agricultural lands to be favoured are those with a market gardening vocation equipped and/or capable of being equipped with hydro-agricultural developments, in particular the irrigated areas in the valley of the Senegal River, the lands around the ponds, the oases, and the peri-urban areas around of Nouakchott and other towns located or supplied from large aquifers (Dhar, Benichab, etc.). A pilot organic farming project on 6,000 ha is supported by international cooperation and identified in the country's national climate strategy (Mauritania country report).

Food security issues lead countries to favour monoculture (cereals, arboriculture and certain horticultural crops), in the same way as for export and niche crops. The diversification of sectors mainly concerns high value added and niche products, reserved for a national elite and for export, including organic farming products.

Organic farming, which is like a form of agroecological agriculture, is making significant progress in the countries of the region, a dynamic that countries are beginning to support in their agricultural programs. These products are reserved for often urban elites.

6 - Measures towards the employment of youth in agriculture in Morocco and Algeria

The countries all aim to promote youth employment in the rural sector. Among the concrete measures identified, we can cite:

Morocco, which aims, by 2030, for the birth of a new generation of young entrepreneurs, through the mobilization and development of one million hectares of collective land and the creation of 350,000 job positions for the benefit of young people (Morocco country report).

In *Algeria*, as part of the 2020-2024 five-year plan, 200,000 ha are intended for 16,000 young people. The latter can also benefit from credits from dedicated schemes through the National Agency for Entrepreneurship Development (ANADE) and the National Unemployment Insurance Fund (CNAC). (Algeria country report).

3.3.2. Synthesis

Through this inventory of measures taken by governments in favour of their agriculture, we can deduce concerning the prospects of agroecological transition that the scarcity of water leads policies to integrate dimensions of precision agriculture, by increasing the efficiency of water use and its recycling. In terms of inputs whose prices have soared, the policy is to support the purchase of conventional fertilizers. No economic measures in favour of access to substitute products that are more respectful of the soil are visible except for

measures to support organic farming. The issue of local seeds is ignored and classic agricultural policy measures based on technical packages persist, with an emphasis on the dissemination of drought-resistant seeds and water savings. These measures, whose environmental component appears residual because they focus solely on water, also support the development of export cultures or food security that consume a lot of water. At the same time, concrete actions are being taken by recent policies to encourage the emergence of new forms of agriculture such as organic farming.

These paradoxes indicate that trapped by the climate and social emergency, governments are continuing established actions in terms of agricultural intensification while implementing some of the priorities resulting from new strategies in terms of sustainable or resilient agriculture, as shown by the case of organic farming. This last point should be linked to the strategic importance of this new sector for export and the growth of national markets.

Finally, the situation shows that not all the measures prescribed by these sustainable and resilient agriculture and water related strategies have been accompanied by obligations, incentives or support in terms of training or advice to social actors[37]. They have had little impact on small-scale farmers, who make up the majority of farmers in these countries. Finally, numerous studies have highlighted the paradoxical effect of approaches focused exclusively on technical interventions, the absence of cross-cutting coordination methods between sectoral policies to limit the external effects leading to the degradation of resources[38]. National sustainable development strategies have been unable to contain ongoing resource degradation processes. Criticism of strategies for the protection of natural resources relates to the limited financial resources allocated to the implementation of environmental strategies.

3.3.3. Some Enabling factors to agroecology in North African Countries

The factors facilitating the agroecological transition are twofold: the permanence of ancient agricultural practices and knowledge in the region preserved thanks to the vitality of family farming, and the action of NGOs and international cooperation to improve and promote them. Weak signals of promotion of agroecology are thus reported in the actions and projects, often pilots, forming part of the political strategies of the countries.

Some practices conducive to a transition to agroecology can be identified. There are those that fall under the umbrella of usual small-scale agriculture, which bring together a majority of small producers. They often use food production systems that are also characterized by a low use of chemical inputs or machinery (mostly for economic reasons). Family work plays a central role, and cropping systems combine cereal crops with pulses. In many regions where family farming is being developed, crops are diversified and marketing methods often resort to territorial markets (weekly souks close to their places of production). There is strong cooperation between producers and solidarity in the mobilization of material resources.

Many development projects have been developed in recent years in the region on line with agroecology. The largest donors (AFD, EU, IFAD, AECID, CCFD-TS, etc.) are interested in the potential of agroecology as a

[37] Because no constraints on water use were imposed, farmers with drip irrigation systems tended to increase the area dedicated to more water-intensive crops (*Jevons' paradox*).
[38] World Bank. Technical Note Water Scarcity and Droughts *Climate and Development Report*. October 2022, 34 p.

means of production for smallholder farmers, and see this system as an approach to adapting to climate change. In these projects, technical itineraries favourable to agroecology are increasingly promoted. Producers are beginning to become aware of the differences between conventional and agroecological products. The consumption of inputs decreases considerably among producers directly or indirectly affected by these agroecology promotion projects. This reduction is made to the benefit of biofertilizers, biopesticides and the use of farmers' seeds. There is also a great diversification of crops within the plots, as well as crop associations and rotations. As mentioned above, these elements are mostly mainstreamed in public policies through support to organic agriculture. Only farmers that can access cost for labelling are concerned.

Several cooperation projects have also developed conservation agriculture since the years 2000 but there is the difficulty of accessing no-till seeders. The non-availability of the no-till drill was the main cause of farmers' return to conventional seeding, according to a conversion initiated as part of a "Conservation Agriculture in the Maghreb" project. The drop in yields after a few years of no-till is also a main reason behind some farmers abandoning no-till. There are technical barriers associated with agroecology that are still only partially resolved, such as weed management in agriculture with reduced herbicide use. Combined with the lack of a dedicated extension program for the agro-ecological transition, these technical barriers limit the adoption of agroecology by farmers. Finally, there is the lack of momentum for the creation of value chains or added value around agroecological products.

Agroecological practices can also be spotted in the oasis system. It combines crops with arboriculture and date palm plantations and uses small-scale livestock farming to provide organic fertilizers. Traditional techniques are combined with a social management of water that has allowed the oasis model to be replicated over centuries.

In almost all countries, associations of young producers and/or young individual entrepreneurs have emerged and are becoming increasingly sensitive to issues related to climate change. Agroecology-oriented agricultural production and awareness raising on local consumption are increasingly taking place in urban areas.

Last, several agro-ecological experiments have been identified in different regions. Among these, we can mention for Morroco, i) the Network of Agro-ecological Initiatives in Morocco (RIAM) which promotes the co-construction of complementary regional networks, encouraging the exchange of agro-ecological experiences specific to each region, ii) the Eco-Solidarity Farmers' Markets in Morocco highlighting the short circuits of sustainable agriculture through these markets, iii) the National School of Agriculture of Meknes which conducts experiments and awareness-raising programs on agroecology for students and producers in the region, iv) the Carrefour des Initiatives et des Pratiques Agro-écologique (CIPA-Pierre Rabhi) dedicated to the sharing of agro-ecological initiatives and practices, and v) achievements in the framework of the Co-creation of Knowledge with agro-ecological narratives that highlight practices and experiences.

In Algeria, subtle signs of the promotion of agroecology are manifesting themselves in the country through various initiatives. The Ministries of Agriculture and Environment, with the support of technical institutes such as the Technical Institute of Field Crops (ITGC), are implementing programmes such as Conservation Agriculture and Seed Development adapted to the different agroecological zones of the country and to climate change. Although the term "agroecology" is not explicitly used, a dozen associations have been identified, testifying to the growing commitment of civil society actors. Emerging practices, such as no-till, crop diversification, agroforestry, and input reduction, indicate a transition to more sustainable methods. As far as

the majority of private initiatives are concerned, they manifest themselves through spaces and online shops specialising in the sale of agroecological products, direct sales at farm level, as well as weekly markets. These developments reflect a move towards more environmentally friendly agricultural practices and reflect an increased awareness of the importance of agroecology among private actors.

To conclude, agroecology is mostly driven by international cooperation and civil society organisations many projects and actions. They answer some priorities defined by recent national agricultural and environmental strategies including climate change.

Box 10: Associations working in the field of agroecology in Algeria

- Association for the Protection of the Environment of Beni Isguen (APEB)
- ADHRAR (local development of the Tazla village)
- TORBA association
- JADE Environmental Ethics for Jil el mostaqbel;
- Association for reflection, exchange and action for the environment and development
- Rainbow Educational and Cultural Association
- Cultural Association for Youth and Childhood
- Association of Fig Growers of the Wilaya of Bejaïa
- Association El-Argoub

Source: National Study

3.4. Analysis of Agroecology in International and Cross-sectoral Policies

Agroecology will be considered in this section from the point of view of health policies, food policies and trade policies, based on elements provided along with the national countries reports.

3.4.1. Health policies

In North African countries, national health policies are mostly focused on controlling and eradicating serious diseases such as hepatitis, tuberculosis and bilharzia, as well as improving maternal and infant health (Algeria, Egypt, Mauritania and Tunisia). These targets have been commonplace since the Millennium Goals were set in 2000 and progress in these areas are significant in most countries.

Despite the recognition of the urgent need to control the growing risks associated with a diet too rich in sugar and fat, and the recent existence of national strategies integrating these new health dimensions (below box), the implementation of large-scale actions is not yet effective, nor seems to be a health policy priority yet.

Pilot actions so far have mainly insisted on the downstream level, with educational objectives and they target consumers, especially the youth, on the need to adopt more healthy diet. The upstream part of the question (the agricultural production) is not questioned.

Recommendations deal more with the type of products consumed insisting on the benefits of fresh and poorly transformed food product without mentioning the environmental context of their production.

Therefore, elements relating the quality of agricultural products to health aspects are not yet clearly linked to the use of agricultural inputs. Agroecology is not mentioned as a potential lever to improve the situation.

Box 11: Integrating nutritional quality of agricultural products in Tunisian and Moroccan health policies

Tunisia recently drew up a multi-sectoral national strategy to promote the health of adolescents and young people, a large part of which is devoted to nutrition for this segment of society (UNFPA, 2017). As part of its programs to promote the nutritional health of adolescents and young people, the country will integrate, alongside the biological dimension of healthy eating, socio-economic and cultural factors that are linked to health, food security and sustainable development.

In 2019, Tunisia set up a National Food Safety Authority. The Instance Nationale de la Sécurité Sanitaire des Produits Alimentaires focuses on the quality of food products and their relationship with the health of Tunisians. In fact, it is the only body responsible for preventing food-related risks, under the direction of the Ministry of Health. Created in 2019, the Instance's mission is to implement and contribute to the design of State policy on consumer protection, plant and animal health safety, animal welfare, and the safety of foodstuffs, animal feed and agricultural inputs, from primary production to the end consumer.

In his 2008-2012 Health strategy Morocco does not refer specifically to diseases associated to bad nutrition impacts, but since 2011 it has launched a nutritional strategy (2011-2019) that integrate the many aspects of nutrition, with four following strategic axes.

1/ Strengthening the nutrition component in health programs

- Promotion of infant and young child feeding
- Prevention and management of nutritional disorders and chronic diseases including cancer during the life cycle
- Prevention and fight against micronutrient deficiencies

2/ Strengthening food and health security

- Strengthening the availability and accessibility of safe and healthy foods

3/ Integration of the nutrition component into educational programs and community actions

- Promotion of nutrition in schools and universities
- Promotion of nutrition at the community level

4/ The development of support measures for the National Nutrition Strategy.

- Implementation of an Information, Education and Awareness plan on nutrition
- Establishment of a nutritional monitoring system
- Development of research and expertise in nutrition

This strategy effectively considers health problems linked to the quality of food in general (processed products in particular), as well as health problems linked to malnutrition, but it considers less health problems linked to the quality of agricultural products. and pesticides.

Source: Inès Zouari and Taha Lahrech

3.4.2. Food policies

The issue of food security has been at the heart of the national agricultural policies of all the five countries in the region since their independence. Still, their objectives of self-sufficiency and reducing food dependency have not yet been achieved. For 50 years, priority has been given to increasing agricultural production in quantitative terms, with intensification through the use of chemical inputs and irrigation, in line with the agricultural strategies currently promoted by the African Union at international level (see infra).

In terms of food, the aim is to give the poorest people some access to basic foodstuffs through food distribution systems and subsidies for basic foodstuffs (Algeria, Tunisia, Egypt), which guarantee a degree of social stability. However, the quality of these products delivered to the poorest is rarely taken into account and the nutritional impacts of such distribution are insufficiently unknown (below Box).

Since access to food does not equal access to healthy food in actual policies, there is little room to foster local agroecological products for the poorest. However, agroecology production is fully online with the principles of justice and mutual aid. And most “traditional” small and medium farmers in the region are involved in local social networks to face the impacts of unpredictable climate and markets and to secure their food security.

Box 12: Nutritional impacts of the ration card system in Egypt

In Egypt, food policies broadly subsidized bread, flour, rice, sugar and cooking oil. Ecker et al. (2016) examined the effect of food policies in Egypt on nutrition. They concluded that the ration card program considerably affected under- and overnutrition, mainly in urban areas; and the Baladi bread and flour subsidy program has notable effects on overnutrition in both urban and rural areas. With increasing subsidy levels, urban beneficiaries seem to increasingly substitute expensive, non-staple foods that are important for child nutrition (meat, fish, milk and dairy product and legume) with calorie-rich and micronutrient-poor foods mainly made from cheap, subsidized sugar and rice. While food policies have been partially reformed in Egypt in recent years39, experts still call for further shifting subsidies towards micronutrient-rich foods and diverse diets, accompanied by nutrition awareness campaigns and education programs.

Source: Elen Lemaître-Curri

In North Africa, when the concept of product traceability is used, it essentially refers alternatively to:

- the agri-food industry and the organisation of supply chains with a view to health and sanitary product control (Algeria, Mauritania)

[39] With the introduction of a cash transfer program targeting the poor.

- quality labelled products, such as those produced by organic farming, which represent an investment niche, particularly for export (Egypt, Tunisia).

Approaches based on quality labels and the relocation of agriculture are known to a small circle of NGOs and researchers, but are not widely used, and are not often accessible to small and medium-sized farming communities. In recent years, some policy innovations have been made to integrate the qualitative dimensions of production into food security policies (below Box). They try to answer in particular the increase of diseases (obesity, diabetes…) related to food consumption change of pattern (Algeria, Egypt, Tunisia and Mauritania) whose social and economic costs are high.

These food strategies nutritional-oriented have yet to be implemented. They can potentially bring forward the nexus between health, food (nutritional) security and agriculture. This nexus is fully online with agroecological agriculture principles and transition.

Box 13: Sustainable food systems at the heart of the Tunisian, Egyptian and Moroccan food and nutrition strategies

In Egypt, a specific strategy has existed since 2007 (Ministry's 10-year National Food and Nutrition Policy and Strategy 2007-2017, NFNPS), but it has not been able to be implemented on a large scale due to a lack of resources. The new phase of this policy, the Action Plan for the National Food and Nutrition Strategy 2022-2030 aims at achieving food security, improving nutrition, and improving the public health.

In Tunisia, a recent food strategy (“La sécurité alimentaire en Tunisie pour l'horizon 2035”) was drawn up by the “Institut Tunisien des Etudes Stratégiques” (ITES), which reports to the President of the Republic, and published in December 2023 (Agrebi et al., 2023). The overall vision for food security in Tunisia up to 2035 is as follows: ‘For an inclusive, sustainable and innovative food system that is resilient to shocks and climate change and with reduced dependence on the outside world’.

The strategic objectives for food security in Tunisia up to 2035 are presented as follows:

- Ensure sustainable food availability with reduced dependence on imports
- Guarantee fair access to food products
- Promote a healthier and less wasteful food consumption pattern
- Adopt a resilient food system capable of anticipating shocks and crises and coping with climate change.

The “Union Tunisienne de l'Agriculture et de la Pêche” (UTAP), with support from the FAO, has also drawn up a national action plan for viable family farming that is better integrated into sustainable food systems (Ben Khalifa et al., 2022). This national action plan is made up of 7 components, each targeting a specific objective:

- The development of an inclusive market environment, promoting short food supply chains and diverse and nutritious food to contribute to more sustainable food systems.

- The establishment of inclusive and equitable value chains with better conditions for family farmers, in particular women, young people and their organisations, encouraging diversification and the production of nutritious food.

Morocco launched its 2011-2019 National Nutrition Strategy supported by the Ministry of Health, which is based in particular on four strategic axes bringing together nine areas of intervention, namely

1/ Strengthening the nutrition component in health programs

- Promotion of infant and young child feeding
- Prevention and management of nutritional disorders and chronic diseases including cancer during the life cycle
- Prevention and fight against micronutrient deficiencies.

2/ Strengthening food and health security

- Strengthening the availability and accessibility of safe and healthy foods

3/ Integration of the nutrition component into educational programs and community actions

- Promotion of nutrition in schools and universities.
- Promotion of nutrition at the community level.

4/ The development of support measures for the National Nutrition Strategy.

- Implementation of an Information, Education and Awareness plan on nutrition
- Establishment of a nutritional monitoring system
- Development of research and expertise in nutrition

This strategy effectively considers health problems linked to food, health problems linked to malnutrition, but it considers less health problems linked to the quality of agricultural products / pesticides.

Source: Inès Zouari, Gamal Siam and Taha Lahrech

3.4.3. Trade policies

Since the conclusion of the Uruguay Round of the World Trade Organisation (WTO) negotiations (1994), agriculture has been subjected to the WTO rules and, with a few exceptions, is treated like most other industrial sectors. Despite flexibility mechanisms, the rules governing international trade (WTO rules enshrined in bilateral, regional and mega trade liberalization agreements) have a critical influence on national sovereignty over agricultural policies (Hoffmann, 2015). WTO rules encourage the specialization of production (based on 'comparative advantages'), as well as concomitant increases in scale to maximize economies of scale. While such measures may decrease the cost of food in urban areas, they do not necessarily increase access to food, as smallholder farmers (vulnerable to food insecurity) tend to reduce self-consumption of diverse food products and often struggle to compete with international imports. In addition, trade agreements do not consider the hidden costs of global agrifood systems, estimated in recent UN publication worth at least USD 10 trillion representing 10% of global GDP (FAO, 2023a).

In MENA countries, economists and Bretton Woods institutions have promoted agri-food trade liberalisation and export-oriented development as a way to support food security and employment in a resource-scarce environment for several decades (see, for example, Lofgren and Richards, 2003; Chaherli and El Said,

200040…). Nin-Pratt et al. (2018), for example, still recommend: reducing protections on staple crops (abandoning policies targeting self-sufficiency); increasing productivity and efficiency in staple crops and crops with export potential; and deregulating labour markets41. Recommendations include moving away from input subsidies and policies increasing water supply by unsustainably tapping water resources, which could align with an agroecological transition. However, other recommendations (e.g., on labour deregulation, trade liberalization and export-orientated crops) widely diverge from an agroecological transition based on sustainable, inclusive and fair local food systems. Expansion of fruit and vegetable production is seen as a source of foreign currencies through export, rather than a solution for a healthier local diet.

Researchers consider trade policies a major barrier to scaling-up the adoption agroecological practices (Parmentier, 2014; Hoffmann, 2015, etc.). "Unfavourable conditions [to agroecological expansion] result from various adverse policy and economic factors such as: the liberalization of agricultural trade42, including through the structural adjustment programs of the IMF and World Bank in the 1980s and 1990s and the Agreement on Agriculture of the WTO, which have among other things significantly contributed to import surges in developing countries" (Parmentier, 2014, p.62).

Abay et al. (2022) specify that in low- and medium-income countries, liberalized trade policies, including easing trade barriers and reducing tariff rates, has often led to an increased consumption of unhealthy foods and sugary drinks. Easing trade barriers encourages flows of foreign direct investment in large supermarket chains and food processing industries, resulting in the substitution of traditional local diets with cheaper (and easily prepared) imported foods, unhealthy processed foods and soft drinks, in particular by poorer households; with import-supplied supermarkets substituting local retail.

Niederle et al. (2022), in their classification of local and national policies conducive to an agroecological transition, put a specific emphasis on value chains, market and trade, with the following five categories of conducing policies: (1) consumer-oriented, (2) producer-oriented, (3) market- and food-environment-oriented, (4) macro and trade-oriented and (5) cross-cutting. Market and trade-oriented policies include: direct market participation, regulation of markets and actors, catalysing new markets, import restrictions…

The national trade policies of the 5 countries are driven by the search for competitiveness and the desire to export (Egypt, Morocco, Algeria). In the agricultural sector, the emphasis is on the development and intensification of high value-added production, mainly fruit and vegetables, but also specific products such as olive oil and dates. The organic farming sector is also being developed mainly for competitiveness and export purposes: in Egypt and Tunisia through the growth of organic exports, in Algeria and Mauritania as a new agricultural priority.

From this point of view, the quest for lower-cost production on international markets is influencing the direction of national agricultural investments, most often to the detriment of small and medium-sized farming. This quest for international competitiveness has led countries to preferably favour access to land for big investors and to

[40] "The key to increased national and household-level food security is pro-poor growth, driven by export-oriented, labor-intensive sectors. Agricultural sector policies should be subordinate to the pro-poor growth goal and not to the goal of food self-sufficiency" (Lofgen and Richards, 2003); "Further trade liberalization could provide MENA with an enabling environment to push for more effective domestic policies." (Chaherli and El Said, 2000).
[41] The authors assess agricultural development in terms of total factor productivity, comparative advantage and efficiency.
[42] Emphasis in the sentences cited was added by the authors.

the establishment of large farms (Algeria, Egypt, Morocco). From qualitative perspective, only organic agriculture has shown to be competitive (Egypt, Tunisia) and it remains marginal at macro scale.

These major trends in foreign trade of agricultural products are in fact holding back the adoption of agroecology by driving both public and private investment toward competitive agriculture a main goal.

Recently and since the COVID, countries have realized the need to strengthen local agricultural production to answer national needs (Mauritania, Tunisia). In particular, Tunisia is developing a current trade strategy, that aims to diversify and replace traditional agricultural exports (olive oil, dates and citrus fruits) with manufactured products, and Morocco has stopped exporting olive oil for two years, due to insufficient national production in a context of climate change and drought.

3.5. Analysis of Agroecology in International and Regional Policies

This section builds on international agreements and international policy research literature to address two complementary questions:

- what policy instruments have been used internationally to scale-up agroecology;
- to which extent do international conventions, agreement and strategies foster or hinder an agroecological transition?

Both questions consider policies in an intersectoral perspective; with agricultural, food, environmental, trade, finance, labour, health and nutrition policies in the scope of analysis.

Our hypothesis in this section is that the scaling-up of areological situations can be only provided through adapted and integrated sectoral policies, at international and national level.

The analysis the documents relies on the presence of agroecology in the documents, directly, and most often indirectly though the High-Level Panel of Experts, HLPE 2019 grid of agroecological grid of principles.

The policies selected for international policies cross sectoral analysis are presented in the **table** below:

Table 13: Policies analysed for the international policy analysis

International frameworks on agriculture and environment ratified by NA countries
A - The **Convention on Biological Diversity** (CBD, 1992), with particular emphasis on the Kunming-Montreal Global Biodiversity Framework (2022) and the Nagoya Protocol (2010). B - The **United Nations Convention to Combat Desertification** (UNCCD, 1994), with specific focus on Decision 7/COP.13: The Future Strategic Framework of the Convention (2018–2030, adopted in 2017); and the Regional Implementation Annex for Africa. C - The **United Nations Framework Convention on Climate Change** (UNFCCC, 1992), with particular attention given to the Paris Agreement (2015) and Decision 3/CP.27 - Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security (2022). D - The **International Treaty on Plant Genetic Resources for Food and Agriculture** (ITPGRFA, 2001).
African Union Policies on agriculture **All North-African countries in NATAE are members of the African Union**
A - The **Comprehensive African Agriculture Development Program**: intensification and productivity B - The **Abuja Declaration on Fertilizer for the African Green Revolution**: to enhance the use of fertilizers
International conventions on labour and participation **(not ratified by NA countries)**

A - International Labour Organization (ILO), with particular emphasis on C184 - **Safety and Health in Agriculture Convention**, 2001 (No. 184) B - The **Aarhus Convention**, formally known as the United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-making, and Access to Justice in Environmental Matters
Health: the World Health Organization
Nutrition and Public Health Policies and the 2023 joint platform initiative, the Coalition of Action on Healthy Diets from Sustainable Food Systems for Children and All (HDSFS)

3.5.1. Scaling-up agroecology through public policy measures: elements of benchmark

Agroecological innovations often remain small-scale. Parmentier (2014) identifies five key challenges for scaling-up agroecological approaches: (i) unlocking **ideological barriers** to political recognition; (ii) supporting **farmer-to-farmer networks**; (iii) providing an enabling **public policy** environment; (iv) taking specific actions for empowering **women**; and (v) improving agricultural and food **governance**.

In term of policy environment, enabling agroecological expansion requires: (i) designing **agricultural and trade policies** in support of peasants and agroecological approaches; (ii) securing peasant's **access to** natural and other productive **resources**; (iii) supplying **public goods**; and (iv) prioritizing agroecology in agricultural **research and extension** (Parmentier, 2014). In particular, "*Reaffecting part of public spending on private goods (such as fertilizers or pesticides that farmers can only afford as long as they are subsidized) to public goods can bring significant sustainability benefits*" (Parmentier, 2014, p.64). Mouratiadou et al. (2024) noted that: "*Given the wide variety of departing farming and farm household conditions, policy support may cover different aspects including an efficient network of **extension services**, increased **farmer-to-farmer** exchanges, responsible **governance** mechanisms at different scales, contributions from **science**, and an enabling policy environment providing **subsidies** to assist farmers to cover extra-costs and losses in the transition period*." Other examples include **public food procurement** programs and improving access to market.

Although many countries have started considering agroecology in theory, few countries - mostly in Latin America and the Caribbean - have demonstrated a capacity to significantly expand agroecology, with broad orchestrated public policy support (Niederle et al., 2022; Ewert et al., 2023). Examples frequently cited in the literature include Brazil and Cuba (Giraldo & McCune, 2019)[43]. In Europe, while no such scaling-up has not been observed to date, structured research and policy efforts are important taking stock of.

A - Lessons learned on policy instruments to scale-up agroecology in Latin America

In a review of agricultural policies in eight Latin American countries, Sabourin et al. (2017) conclude that "the construction of agroecological policies involves three processes: pressure from the social movement, crises and government initiatives"; and that "There is a large variety of instruments dispersed in different public sectors with great difficulty of coordination. However, actions for **access to land, water, credit and technical assistance for family and peasant farmers** are the best basis for negotiating more specific programs for the agro-ecological transition."

[43] Niederle et al. (2022) also examine examples from India, Senegal, France and Nicaragua.

Public policies are only one of the key elements driving this expansion, alongside factors such as: (i) recognition of a crisis that motivates the search for alternatives, (ii) social organization, (iii) constructivist learning processes, (iv) effective agroecological practices, (v) mobilizing discourses, (vi) external allies, and (vii) favorable markets (Mier y Terán Giménez Cacho et al., 2018).

B - Policies and policy research in Europe

Whereas agroecological practices remain marginal in Europe, recent EU policies towards AE can also be insightful. Recent research and innovation funding programmes in the EU, such as Horizon Europe, explicitly support agroecology. The Farm to Fork Strategy (FFS), at the heart of the European Green Deal, aims to make food systems fair, healthy and environmentally-friendly. The FFS specifies that "*the new 'eco-schemes' will offer a major stream of funding to boost sustainable practices, such as precision agriculture, agro-ecology (including organic farming), carbon farming and agro-forestry*." It also commits that new knowledge and innovations will scale up agroecological approaches in primary production through a dedicated European Partnership 'Accelerating Farming Systems Transition: Agroecology Living Labs and Research Infrastructures', launched in January 2024. Finally, the FFS states that the EU will focus its international cooperation on food research and innovation, with particular reference to agroecology, among other approaches.

In Europe, only France has adopted a structured policy in favour of an agroecological transition (Lampkin et al., 2021). Germany strongly focuses on organic farming, and the United Kingdom engages with both on a more limited basis. "*In policy terms, France has taken a lead in the development of agroecology, both nationally and internationally, including as the lead sponsor of the first FAO Agroecology Symposium in Rome in 2014*" (Lampkin et al., 2021, p.104). In 2010, France's national research institute, INRAE, designed a research agenda on agroecology. In 2012, a new policy aimed to organise collective changes in farmers' practices; with support to collective projects combining economic profitability and environmental performance. In particular, **legal innovation** allowed for the establishment of **economic and environmental interest groups** (GIEE), with facilitated access to French and European **support schemes for technical assistance and project funding**. By 2019, about 2% of French farms had joined GIEE. GIEE thus remain a marginal alternative option, but are an important asset for collective innovation. In addition, the discursive work has borne fruit in legitimising agroecology in France and helping put it on the global agenda (Loconto and Fouilleux, 2019). Policy instruments supporting agroecology are not very specific in the scope of practices supported. But some authors consider the performative indeterminacy of policy instruments as an asset for agroecological transitions (Lamine et al., 2020). To date, agroecology is still gaining momentum as a key building block for a transition towards sustainable and healthy local food systems; with **public food procurement programs** one of the drivers.

C - Supporting agroecology and-or organic agriculture?

Sabourin et al. (2017) analyse that, depending on countries and periods in their trajectories, organic agriculture and agroecology can either complement each other or compete; organic agriculture being easier to regulate and certify. In Latin America, agroecology is strongly associated to a political movement, more radical than organic agriculture. Organic agriculture is often export-oriented and driven by certification for international markets; whereas agroecology has developed without focus on certification (or through participatory certification approaches) through local markets and local food systems (Sabourin et al., 2017).

In Europe, organic agriculture emerged first, in the context of an alternative perception of the relationship between human and nature, an alternative life project. The concept of agroecology long stayed confidential, and emerged in the public policy arena at the favour of technical and scientific concerns for sustainability rather than political mobilization in favour of peasant farmers. So, the radical nature of agroecology as a social movement is much less pronounced in Europe than in Latin America. Organic agriculture is often a key component of an agroecological local food system rather than an alternative option aiming at a separate market. Policy instruments in favour of organic agriculture have long been integrated in public policies[44], and de facto contribute to supporting an agroecological transition.

In North Africa, agroecology is only recently emerging in policy discourse, mostly through urban citizen associations and development projects. It is not rooted to date in a social movement in favour of peasant farmers. The drivers of organic agriculture development vary across countries, with strong focus on export in Egypt, for example, and interest from niche urban markets in Maghreb countries. In this very early stages of development, North Africa has the opportunity to draw its own pathway, with agroecology a key component of a transition articulating sustainable agriculture in resource-scarce environments, with nutritious and healthy local food systems.

As described in the section below, drawing such pathway requires a coherent intersectoral policy framework. Articulating commitments taken in various international policy arenas (including environmental, health and nutrition frameworks) could be part of the solution. However, other international agreements and strategic frameworks are still far from fostering an agroecological transition, as detailed below.

3.5.2. Analysis of international and regional frameworks

The analysis of international and regional frameworks, conventions and agreements within the scope of NATAE has been structured around two primary criteria:

a. **Potential Impact on Agroecological Transition**: Each framework is assessed based on its capacity to either facilitate or hinder the agroecological transition. This evaluation considers the extent to which the framework aligns with principles and practices conducive to agroecology.

b. **Ratification by NATAE Project Countries**: This work has prioritized the analysis of regulatory frameworks ratified by North African (NA) countries, ensuring that our findings remain relevant and applicable within the scope of the project. However, it is equally essential to this analysis to explore frameworks and conventions that have not been ratified by NATAE countries. This broader exploration allows us to identify specific neglected areas and elements in NA that may require further consideration from both legislative and policy perspectives. Addressing these issues could play a key role in promoting a more holistic agroecological transition.

In the analysis of the different international and regional policies, our goal has been to identify information that directly or indirectly aligns with the 13 principles of Agroecology outlined by the HLPE. This initial overview

[44] Those instruments have limitations, broadly covered in the literature.

serves to highlight which of these principles have received the greatest attention and which have been relatively neglected.

3.5.2.1. International frameworks on agriculture and environment ratified by NA countries

International frameworks on agriculture and environment examined include:

- The **Convention on Biological Diversity** (CBD, 1992), with particular emphasis on the Kunming-Montreal Global Biodiversity Framework (2022) and the Nagoya Protocol (2010).
- The **United Nations Convention to Combat Desertification** (UNCCD, 1994), with specific focus on Decision 7/COP.13: The Future Strategic Framework of the Convention (2018–2030, adopted in 2017); and the Regional Implementation Annex for Africa.
- The **United Nations Framework Convention on Climate Change** (UNFCCC, 1992), with particular attention given to the Paris Agreement (2015) and Decision 3/CP.27 - Sharm el-Sheikh joint work on implementation of climate action on agriculture and food security (2022).
- The **International Treaty on Plant Genetic Resources for Food and Agriculture** (ITPGRFA, 2001).

The only document that explicitly refers to 'agroecology' is the Kunming-Montreal Global Biodiversity Framework, particularly in its Target 10. In addition, the UNCCD stresses the importance of incorporating sustainable agricultural practices into national action programs, while UNFCCC Decision 3/CP.27 emphasizes the imperative of designing sustainable and climate-resilient agricultural systems. Indeed, in recent years, the fact that agri-food systems are estimated to contribute above 30% of greenhouse gas emissions (Tubiello et al., 2022) has attracted increased attention in climate negotiations.

Although the reference to agroecology is rare in the Rio convention process of decisions, recent COPs have shown that side-events are organised regularly on agroecology, notably by NGOs and scientists in the frame of these environmental agreements meetings.

And while the term 'agroecology' is rarely present in international agreements, some of the 13 HLPE principles for an agroecological transition are addressed in international agreements on environment and agriculture.

- **Soil Health**: Target 11 of the Kunming-Montreal Global Biodiversity Framework emphasizes the crucial need to restore, maintain and improve soil health, among other factors. The UNCCD emphasizes that land degradation, resulting from processes such as soil erosion and deterioration of its physical, chemical and biological properties, is a primary concern. Given the Convention's central goal of combating land degradation and desertification, preserving and restoring soil health emerges as a central objective. In addition, the Paris Agreement, Article 5, encourages parties to act to conserve and enhance, where appropriate, greenhouse gas sinks and reservoirs. Given that soil represents the largest carbon sink on Earth, this provision can be interpreted as an indirect call for soil conservation.
- **Biodiversity:** No provisions or targets related to this principle were identified in the Paris Agreement. However, the interconnected relationship between agriculture and biodiversity is more clearly articulated in CBD, ITPGRFA and UNCCD documents. Target 10 of the Kunming-Montreal Global Biodiversity

Framework specifically urges nations to ensure "*that areas under agriculture, aquaculture, fisheries, and forestry are managed sustainably, in particular through the sustainable use of biodiversity*". The ITPGRFA, in Articles 5 and 6, requests contracting parties to promote policies that support an integrated approach towards the conservation and sustainable use of plant genetic resource for food and agriculture and that favour the maintenance of diverse farming systems to enhance the sustainable use of agricultural biological diversity. The UNCCD calls for the adoption of an integrated approach that addresses, among others, the biological aspects of the processes of desertification and drought. In Article 8 of its Regional Implementation Annex for Africa, the UNCCD mandates national action programs to incorporate measures to ensure integrated and sustainable management of natural resources, with a specific focus on biological diversity. Finally, the UNCCD 2018–2030 Strategic Framework lays out 5 strategic objectives and their expected impacts. Expected impact 4.1 emphasizes that sustainable land management and efforts to combat desertification are expected to contribute to the conservation and sustainable use of biodiversity.

- **Land and Natural Resources Governance** and **Fairness:** The CBD and UNCCD respectively incorporate targets and articles aimed at safeguarding and promoting traditional and local knowledge and the rights of indigenous peoples over their ancestral lands. In addition, both conventions commit to ensuring that custodians of traditional knowledge are involved in a fair and equitable manner in benefit-sharing arrangements related to the commercial use of such knowledge and associated genetic resources. The Nagoya Protocol, adopted in 2010, serves to advance the third objective of the CBD, which focuses on ensuring the fair and equitable sharing of benefits arising from the use of genetic resources and associated traditional knowledge. Article 7 of the Protocol stipulates that traditional knowledge held by indigenous and local communities must be accessed with their prior informed consent or approval and active involvement. This provision strengthens the CDB legal framework, enabling these communities to benefit from the use of their knowledge and practices. Finally, Art. 9 of the ITPGRFA states that *"the responsibility for realizing Farmers' Rights, as they relate to plant genetic resources for food and agriculture, rests with national governments",* which should act to protect their farmers' traditional knowledge.
- **Participation:** This principle is present in all four international conventions and treaty, although with slight variations depending on the nature and objectives of each document. Those documents uniformly strive to promote equitable, inclusive, transparent and gender-responsive participation of local communities in decision-making processes.

The most prominent agroecological principles that received comparatively less attention are:

- **Input reduction**: It is only addressed in Target 7 of the Kunming-Montreal Global Biodiversity Framework.
- **Animal health**: No document refers to the need to ensure animal health and welfare.
- **Connectivity**: No document focuses on promoting fair and short distribution networks.

3.5.2.2. African Union Policies on agriculture

All North-African countries in NATAE are members of the African Union, which has adopted specific policy frameworks on agriculture.

- **The Comprehensive African Agriculture Development Program**

Sustainable use of resources is an important component of the 2003 Comprehensive African Agriculture Development Program (CAADP), adopted in the framework of the African Union 2063 initiative. However, CAADP focuses largely on production and productivity growth, with the goal to "*At least double agricultural productivity (focusing on Inputs, irrigation, mechanization)*" by 2025. Nutrition goals are limited to reducing stunting and underweight.

In recent years, international priorities have broadened towards healthy and nutritious diets. However, in 2014, the African Union heads of state and governments reaffirmed their commitment to the CAADP principles in the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods. National performances are regularly assessed through a CAADP Biennial Review, with the following key criteria: (i) Access to agricultural inputs and technologies; (ii) Agricultural productivity; (iii) Postharvest loss; (iv) Social protection; (v) Food security & nutrition; (vi) Food safety. Access to agricultural inputs and increasing productivity remain top priorities.

- **The Abuja Declaration on Fertilizer for the African Green Revolution**

Adopted in 2006 during the Africa Fertilizer Summit held in Abuja, Nigeria, this declaration underscores the critical role of fertilizer in achieving Africa's economic development goals and addressing food security challenges. It highlights the urgent need to increase fertilizer use across the continent to combat declining soil fertility and boost agricultural productivity. The declaration calls for strategic investments, policy harmonization, and targeted subsidies to improve farmers' access to fertilizers. It also emphasizes the importance of regional cooperation, infrastructure development, and financing mechanisms to facilitate the production, distribution, and use of fertilizers in Africa. The declaration sets ambitious targets to significantly increase fertilizer application rates and establishes a framework for monitoring and evaluating progress towards achieving these goals. Additionally, it paved the pathway for the establishment of the Africa Fertilizer Financing Mechanism with the aim to mobilize resources and support initiatives aimed at promoting fertilizer use and agricultural development across the continent. While this policy orientation aligns with the Malabo Declarations of 2003 and 2014, it might hinder an agroecological transition; by concentrating public funds in private access to cheap fertilizers rather than investing in the public goods necessary for an agroecological transition (Parmentier, 2014).

3.5.2.3. International conventions on labour and participation (not ratified by NA countries)

- **International Labour Organization (ILO),** with particular emphasis on C184 - Safety and Health in Agriculture Convention, 2001 (No. 184).

While no North African country has ratified the ILO Convention on Safety and Health in Agriculture, its articles align closely with key agroecological principles referenced in this analysis, particularly regarding social values and fairness. Article 3 emphasizes the importance of addressing hunger through social protection initiatives that prioritize vulnerable groups, advocating for robust food and cash reserves to mitigate food shortages. It also sets the goal to significantly reduce under-nutrition rates in Africa by 2025. Article 4 aims to foster inclusive agricultural growth by, among other things, facilitating the participation of women and youth in economically viable agricultural value chains. Lastly, Article 6 seeks to enhance the resilience of livelihoods and production systems to climate variability and related risks, encompassing both environmental and social dimensions of

resilience, including social security for rural workers. ILO Code of Practice for Safety and Health in Agriculture (2011)[45] gathers a number of norms and best practices to serve as references in public policies and private guidelines. It promotes a multi-actor and inclusive approach, with specific recommendations addressing the conditions of women, young workers, seasonal and migrant workers. It strongly recommends developing national policies, systems and programmes for occupational safety and health in agriculture.

The **Aarhus Convention**, formally known as the United Nations Economic Commission for Europe (UNECE) Convention on Access to Information, Public Participation in Decision-making, and Access to Justice in Environmental Matters.

The Aarhus Convention is an international treaty promoting environmental democracy, entered into force in 2001. It is open to all countries and regional economic integration organizations that are members of the United Nations Economic Commission for Europe (UNECE). Therefore, Algeria, Egypt, Morocco, and Tunisia could accede to the Aarhus Convention. The convention ensures the right of the public to access environmental information held by public authorities. This includes information about environmental policies, decisions, and the state of the environment. Moreover, the convention promotes public participation in environmental decision-making processes. It establishes principles and procedures to facilitate public involvement in decisions that may affect the environment, such as the development of policies, plans and projects with significant environmental implications.

As underlined by Niederle et al. (2022, p.25) in the conclusion of their international policy analysis: "*progress* (…) *can be tackled by putting in place new scientific platforms and mechanisms that bring together actors at national and sub-national levels to discuss food and agriculture transformation. These platforms will allow for mutual learning, policy coherence, long-term support and implementation at multiple levels (e.g. from the farm to the national government)*". This analysis puts the question of participation at the centre of the discussion on agroecological transitions.

3.5.2.4. Recommendations from the World Health Organization: Nutrition and Public Health Policies

North African countries are affected by considerable increases in the prevalence of overweight and obesity in particular among both women and children, reaching record-high rates of premature deaths attributable to obesity (IHME, 2019). A better integration of food, agriculture, nutrition and health policies is a critical condition to address both the challenges of sustainable agriculture, in a context of scarce and degrading resources, and public health.

Over the past decade, there has been growing international recognition of the critical interplay between agricultural policies, nutrition, and public health. The 2012 Comprehensive Implementation Plan on Maternal, Infant, and Young Child Nutrition by the World Health Organization (WHO) underscored the necessity of shaping the food system to mitigate the risk of childhood obesity. It advocated for agricultural policies to prioritize **investments** in small-scale agriculture and promote the cultivation of **nutrient**-rich **fruits, vegetables, and**

[45] https://webapps.ilo.org/wcmsp5/groups/public/---ed_dialogue/---sector/documents/normativeinstrument/wcms_161135.pdf

crops. Governments are advised to review sectoral policies in agriculture to determine their impact on nutrition, and integrate nutrition indicators into agricultural policy evaluations.

At the 75th World Health Assembly in 2022, Member States endorsed the WHO Acceleration Plan to Stop Obesity, emphasizing the need for coherent agricultural policies to support sustainable food systems; and adopted the Recommendations for the prevention and management of obesity over the life course. While the Acceleration Plan does not mention agriculture, the Recommendations advice governments to build a more coherent and enabling agricultural policy, for reduced daily calories from fats and sugars, and increased intake of grains, legumes, nuts, vegetables and fruits; in particular through Food-based dietary guidelines that provide guidance for food and agriculture policies.

WHO food systems for health priority actions include: (i) **Regulating the marketing** of food and beverages to children of all ages; (ii) **Nutrition labelling**; (iii) **Reformulation** of food and drink products; (iv) **Fiscal policies** levying taxes on unhealthy food options (e.g., high in fats, sugars or salt) and subsidies to reduce the price of healthy options; (v) **Public food procurement** policies that prioritize healthy diets; (vi) **Food fortification**; and (vii) **Food safety**. Agroecology is not cited by WHO, but most priorities align with an agroecological transition[46]. Policy measures supporting a healthy diet and agricultural sustainability objectives are likely to be mutually beneficial, agroecology providing a local healthy alternative to unhealthy food products and beverages.

In May 2023, the General Assembly on the prevention and control of non-communicable diseases, and mental health identified 28 front-runner countries to receive priority support from WHO in this area, including Egypt and Tunisia. Countries shall be supported in the development of tailored country road maps with clearly identified priority interventions tracked across mid-term (2025) and long-term (2030) targets and a clear pathway towards implementation. WHO also encourages intercountry and multistakeholder dialogue through a joint platform: the Coalition of Action on Healthy Diets from Sustainable Food Systems for Children and All (HDSFS). By July 2023, no North African country had joined the coalition.

The Africa Common Position on Food Systems (African Union, 2021) reflects most WHO priority policy actions for food systems. In particular, it encourages measures coherent with an agroecological transition: (i) Promoting **biofortification** of staple foods and industrial fortification of complementary foods; (ii) Expanding cash transfer programs reaching families with nutrition services and programs that focus on producing nutritious foods; (iii) Expanding **school feeding** programs and creating **markets** for locally produced foods to increase farmer incomes; and (v) Introducing **subsidies** for healthy and sustainable foods, **taxation** for unhealthy foods, and **procurement policies** for healthy school meals (Nanema et al., 2023).

However, according to recent research, North African countries still fall short of implementing recommended policy measures. Nanema et al. (2023) reviewed commitments pledged by African Heads State to the WHO and concluded that few align with WHO priorities. In Tunisia, only the 'food safety' priority is identified as reflected in national commitments; while political commitments listed in Egypt (9), Mauritania (3) and Morocco (4) do not cover any of the 6 priorities. The authors conclude that "*Policy incoherence across sectors and the*

[46] The contribution of agroecology to food safety is not obvious, but other priority actions are fully coherent with an agroecological transition.

misalignment of food security and nutrition policies are (…) significant problems that lead to fragmentation throughout the regulatory system in Africa" (Nanema et al., 2023, p.57).

3.5.2.5. Finance policies

Funding agroecological transition

Mainstream financial instruments are often inappropriate to fund agroecological transition (loans, equity capital markets, etc.). Estimating return is much more complex than in monocropping systems. Investments often need to be tailored to local conditions and integrated systems progressively established, through a multi-year adaptation phase. Funding collective investments requires formalizing cooperation and solidarity mechanisms.

In this context, authors insist on the importance of public subsidies and public funding schemes, including direct payments, cross-compliance, price support, result-based payments for ecosystem services, green public procurements, conditional loans, etc. (e.g., Gava et al., 2022, in a review of policy schemes in Europe). While farmers are often the main beneficiaries of those funding schemes, actors in the value chain can also be targeted, including both downstream value chains (agroecological product transformation and marketing) and upstream value chains (e.g., development of tailored machinery and alternative inputs).

Mobilizing large investments through public-private or private-private partnerships

Funding large infrastructures and agricultural investments remains the key orientation of both private and public funding programs. Recent examples in North Africa include the launch of an agri-finance platform in October 2023, by The International Finance Corporation (a member of the World Bank Group)[47], and Morocco's OCP Group, the world's largest phosphate-based fertilizer company. The two founding institutions aim to mobilize USD 800 million of private investment for African countries by 2030. By providing access to financing and skills training, the platform seeks to strengthen 30 agricultural value chains across Africa through 60 agri-finance operations, covering a wide range of crop types. The platform has already partnered with Bank of Africa to improve access to fertilizers and other inputs for African farmers and agri-processors (FAO, 2023b). In Egypt, Afreximbank granted a USD 400 million loan to support a phosphatic fertilizers project in August 2023; in October 2023, a Qatar-based dairy production company, signed a cooperation agreement with the Egyptian state-owned entity, Suez Canal, planning for an investment up to USD 1.5 billion, including a cattle farm with an initial capacity of 20 000 dairy cows and a vast 113 000 hectares of crop area in the New Valley Governorate; at the end of 2023, an United Arab Emirates agribusiness was negotiating to progressively acquire an additional 210 000 hectares of reclaimed land in the New Valley Governorate (FAO, 2023b). In April 2024, the Ministry Agriculture and Rural Development of Algeria signed a USD 3.5 billion deal with a Qatari firm to develop the 'world's largest dairy farm', as well as a crop, meat and powered milk production over 170 000 hectares[48]; with the Algerian state retaining 49% of the shares through its National Investment Fund, according to a press article.

The acceleration of very large scale private agricultural investments in recent years, often with public support or in negotiation with public entities, goes in a direction very different from an agroecological transition.

[47] IFC is the largest global development institution focused on the private sector in emerging markets. https://pressroom.ifc.org/all/pages/PressDetail.aspx?ID=27816

[48] https://www.al-monitor.com/originals/2024/04/algeria-signs-35b-deal-qatari-firm-develop-worlds-largest-dairy-farm#ixzz8aVzXLKsi

3.5.3. Synthesis

International frameworks on agriculture and environment ratified by NA countries
They align with agroecological principals (HLPU, 2019) though not explicitly targeting, mentionning or refering to agroecology itself**.**
World Health Organization and nutrition
Nutrition and Public Health Policies and the 2023 joint platform initiative, the Coalition of Action on Healthy Diets from Sustainable Food Systems for Children and All (HDSFS) (not joined by North African countries). Align with agroecolocy principles. National health and nutrition policies exist in Egypt and Tunisia and are not yet effective.
International conventions on labour and participation
They do align with some agroecological principles but they are not ratified by NA countries.
African Union Policies on agriculture
All North-African countries in NATAE are members of the African Union. Policies that are mainly directed to agricultural intensification though the wide use of chemical inputs.
Trade policies
WTO recommendations and national trade policies are aligned, focused on competitiveness, comparative advantages and scales of economies. Mainly an obstacle to agroecological transition.
Food policies
The quality of agriculture is not yet recognized as a public benefit but rather as a competitive asset for export when labelled. Countries suffers from food shortage : access to basic food as a priority for the poorest is provided without nutritional perspective. Do not align with agroecology.

Chapter Four Agroecology in Training and Research and Its Perception by Various Stakeholders in North Africa

4.1. Agroecology in National Training, Research and Information Programmes

The analysis of agroecology's integration in national training, research and information programs in North African countries under this study reveals a varied engagement across Mauritania, Egypt, Algeria, and Tunisia. While dedicated research on agroecology is largely absent overall, related themes and international cooperation projects are seen as the main contributor to the knowledge base, skill development, and information dissemination in these countries. Training modules and project-based learning are key components in promoting agroecological practices, indicating a growing awareness and incremental adoption of sustainable agricultural methods. This section provides a quick look into how agroecology enters in the research sector and acess to information and capacity building. It should bo noted that one of the NATAE project's partners, the INAT, are responsible for an entire Work Package (WP7) which analyses in its first task the academic and professional trainings in partner countries on agroecology and will provide a review and recommendations on that basis. (*WP7: Introducing AE in Education and extension on North African Agriculture / Task T7.1: Review and analysis of existing education programmes, proposing new curricula & content*). This is why this section provides the first observations with that regards without the topic being its direct not major objective, with more details being developed through WP7 as the project progresses. Yet, it was interesting to ask a first question in line with the investigations of this task on how does agroecology place when it comes to national research, existing and potential skills, and information available per every studied North African country.

- Case of Mauritania

In Mauritania, there is no dedicated research on agroecology reported. Current research themes are shown to focus on fruit crop production, the wheat seed production program, and the forage crop development program. National and international NGOs have developed some skills in agroecology, primarily through technicians and engineers, and these skills are transferred to farmers via various project initiatives. Available information on agroecology covers topics mostly related to its technical agrocomic practices such as tillage, insect and disease control, organic soil amendment, crop fertilization, water resource management, soil defense and restoration, crop association, and rotation.

- Case of Egypt

In Egypt, there is no dedicated research on agroecology, but some related research topics include organic farming, water-saving plants, and intercropping. Research and training programs are available on organic farming, environmental sustainability, and sustainable development. While there are no specific skills dedicated to agroecology, international cooperation projects have introduced related practices. For example, the FAO project on sustainable management of agroecological systems in "Kharga Oasis" in New Valley Governorate enhances technical capacity, financial means, knowledge, and support for local communities and smallholders. This project involves 105 Farmer Field Schools, benefiting farmers with new practices for crops like fava beans,

wheat, tomatoes, and fodder crops, as well as new methods for producing organic fertilizers and pest control. There is no specific extension information on agroecology in the country, but information on organic farming and the so-called “strategic crops” essential for food security is provided by the extension services of the Ministry of Agriculture.

- Case of Algeria

In Algeria, agroecology-related activities and information are concentrated in international cooperation projects and NGOs. An example would be the upcoming Agro-Eco 4 JUGG project, "Agroecology for Fair and Sustainable Groundwater Governance." This project is coordinated by DELFT's IHE (Higher Institute of Education) of the Netherlands under the Water and Development Partnership Programme (WDPP), co-funded by the Dutch government and UNESCO.

- Case of Tunisia

In Tunisia, there is no direct research dedicated to agroecology. However, there are training modules aimed at raising awareness of agroecological concepts and approaches, knowing that the NATAE project involves a specific work package (WP7) managed by INAT, aimed at analyzing curricula from an agroecology perspective in North Africa and Europe. International projects related to agroecological practices in Tunisia include the PACTE project (2019-2024), "Climate Change Adaptation Program for Vulnerable Territories in Tunisia," which focuses on agroecological transition in regions like Bizerte, Kairouan, Le Kef, Sidi Bouzid, and Siliana. The Conserve Terra project, a PRIMA project "Towards Conservation Agriculture in the Mediterranean Area" involving ICARDA, INGC, and INRAT, focuses on no-till farming behavior. The Prosol project (2019-2024), "Soil Protection and Rehabilitation to Improve Food Security," promotes soil-conserving crops and erosion prevention, funded by GIZ/Ministry of Agriculture.

Box 14: Main common observations of agroecology in research, skills and information access in North African countries

What is ultimately commonly observed in the studied North African countries is that agroecology is not recognized as a distinct area of research but rather encompasses various related topics such as irrigation, organic farming, and crop association and rotation. There are no specific scientific skills uniquely attributed to agroecology that enter into any dissemination or extension services. However, there are training courses available on organic farming, environmental sustainability, and sustainable development, particularly in Tunisia, aimed at raising awareness of agroecology. Professional expertise in agroecology in North Africa therefore remains predominantly found within NGOs that collaborate with international donors. The focus on agroecology is primarily within the context of international cooperation projects in countries such as Tunisia, Egypt, Morocco, and Algeria. Although agroecology is not a research priority by itself, there are themes closely related to it, often addressing water-related issues. Training modules on these topics exist in some countries, but they tend to be general and do not impart specific skills. Furthermore, the extension system is weak within the region, and the state of information on agroecology themes varies across different countries.

4.2. Stakeholder Perception

The perception of agroecology reported among the different stakeholders interviewed in North Africa presents a complex and multifaceted picture. How agroecology is understood and perceived by different stakeholders is an important factor which impacts the development and implementation of policies. Therefore, one of the main objectives under the task is to understand this perception as a dimension of the general understanding of the obstacles or factors favourable to agroecology. This analysis explores into the perspective of farmers, researchers, NGOs and professional organizations, and representatives of public authorities, highlighting the diversity in awareness, practices, challenges, and priorities associated with agroecology in the region. The main methodology mobilised to develop this information was based on an interview guide that included questions for different categories of actors on their perception of agroecology and this around the following axes:

- Knowledge of the subject
- And if so; what does agroecology mean to them
- How is it envisaged? a constraint? a necessity?
- If it is a necessity, why? and if it is a constraint why?
- What are the risks and benefits of practicing agroecology?
- What are the needs for adopting agroecology?

The actors that were recommended to be interviewed included: farmers (different types of farmers), researchers, representatives of collective structures (cooperatives, chamber of agriculture), extension workers, representatives of public institutions (ministries and others, etc.), NGOs.

This section presents the observations on a country basis and is followed by a general analysis of common observations across North Africa.

Country observations

- Case of Tunisia

In Tunisia, the perception of agroecology as seen to significantly vary among different stakeholders, reflecting both an interest in and barriers to its adoption. For farmers, it was seen that half of the farmers surveyed perceive agroecology as the integration of ecological principles into agriculture, with another 40% being unfamiliar with the concept. This knowledge has largely been acquired through projects and resources accessible through the internet. The reported existing agroecological practices include ploughing, using manure, and reducing the use of phytosanitary products. While there is interest in agroecology, farmers express a need for technical advice and extension services, primarily to enhance soil fertility and optimize land use. Researchers reported to have a general understanding of agroecology, associating it with eco-friendly and conservation agriculture. About 50% believe it is adapted to the local context, with existing practices such as manure application, crop rotation, and soil cover. Reported barriers identified include technical challenges, land issues, political constraints, and a lack of awareness among farmers and consumers. On another hand, government officials in Tunisia are seen to view agroecology in the form of production systems that conserve natural resources and protect the environment. Sixty percent believe it is adapted to the local context and is considered as a priority, although

40% prioritize water management and increasing production. Interestingly, many officials could not cite specific agroecological policies, citing obstacles like the risk of reduced yields, lack of technical mastery among farmers, and low adherence. Yet, favourable factors cited include the need to manage scarce natural resources, the promotion of organic farming, and labelling. When it comes to NGOs, Cooperatives, and Professional Organizations, these groups universally understand agroecology as environmentally friendly production systems and see it as a necessity for conserving biodiversity and ensuring sustainability. Fifty percent highlighted the need for political support and continuous training, while the other half emphasized popularization and awareness-raising. The main barriers they cited include the lack of knowledge, expertise, high costs, resistance to innovation, and rooted habits.

- Case of Egypt

In Egypt, the understanding and implementation of agroecology also show considerable variation across different stakeholders, influenced by the distinct agricultural landscapes of ancient lands and new reclaimed areas. Starting with the perception of farmers, it was seen that most small and micro-farmers are unaware of agroecology in the ancient lands of the valley and the Delta mainly due to their very small holdings. Medium-sized and family farms are reported to practice agroecology by integrating livestock with agricultural farming and using manure, while large farms favour intensification for the purpose of higher yields. In new lands, where soils are less fertile and require chemical fertilizers, farmers prefer high-value intensive crops due to high production costs. The main barriers cited by farmers include land fragmentation, micro-farms, and the lack of accessibility to extension services and technical advice. Researchers in Egypt reported their familiarity with agroecology through scientific publications, though it is not a priority in research programs. Research focuses on specific technical and agronomic practices like crop combination to improve soil fertility or combat diseases, but there is disagreement on practices like the use of certified seeds versus local seeds. Researchers and scientist have reported that the lack of political interest and research funding are major obstacles. When it comes to regulatory bodies, it was seen that even though government officials understand the basic principles of agroecology, they remain generally unconvinced of its value, prioritizing intensification for food security objectives. For those who see its value, obstacles include the lack of research funding and disconnection between research and public policy. NGOs on another hand, that are in connection with international donors, are informed about the concepts of agroecology, unlike other NGOs and cooperatives who do not have international connections. In that case, the primary obstacle identified is the lack of technical advice and extension support to farmers.

- Case of Morocco

In Morocco, different stakeholders show an awareness of agroecological principles but are seen to face important challenges in its implementation. Small family farmers are noticed to understand agroecology in the form of agricultural practices that protects the environment and natural resources, practicing water conservation and crop rotation. Medium-sized farms share this understanding but avoid agroecological practices due to perceived technical and financial risks and the need for income security. With farmers, the lack of technical knowledge and agricultural advice is reported as a significant barrier. At the level of researchers and scientists, researchers in Morocco define agroecology as considering ecological health in agriculture. Although there is research on related topics, the lack of budget restricts priorities to available funding opportunities. They see

agroecology as necessary in resource-poor countries, despite its challenges in balancing environmental preservation with income and yield security. For government officials, they are reported to recognize agroecology as ecologically-sensitive agriculture but believe the national context does not support spontaneous agroecology as is the case in resource-rich countries due to low yields and high social expectations. Low yields force officials to be more demanding of what is expected of resources, and therefore less open to agroecology. An example was provided by one of the interviewed officials describing that with an average farmer who has less than 5ha, social expectations are higher than with a farmer with more than 40 hectares under favourable rain. Therefore, in reality, the social, economic and climatic situation is distancing the country from spontaneous agroecology, which necessitates the need for an induced agroecological approach. In fact, it was reported that the question of agroecology, despite being a priority in the sense of officials being strongly conscious about it, remains diametrically contradictory with socio-economic interests. Therefore, in a situation of arbitration, officials are not able to set ecology as an absolute constraint. In the perspective of officials, there remains some constraints. These include the fact that agroecology is a concept whose consistency requires clearer definition. Additionally, the social and economic impacts of agroecological actions are considered to need evaluation across short, medium, and long-term timeframes with the need to identify what concessions must be made in the short term and explore strategies to mitigate them. Furthermore, the challenge of waiting for a long-term ecological return on investment was also raised. Finally, in the case of Morocco, cooperatives were reported to view agroecology as a means to preserve resources and the environment, but fear losing yield and income without reliable alternatives. In their perspective, barriers include a lack of technical knowledge, advice, and information, alongside concerns for security.

- Case of Algeria

In Algeria, agroecology is less known among farmers, though some have adopted various practices depending on their region. For farmers familiar with the term agroecology, they are seen to connect it between agriculture and nature. They consider that it includes practices as composting, organic manure, economical irrigation, intercropping, and agroforestry. Smallholder farmers often use these as means for less costly production methods. The main obstacle in their perception is that agroecology is less profitable due to lower initial yields. Researchers on another hand are aware of the concepts of agroecology, an observation possibly also true for NGOs since the two that were interviewed are actively engaged in environmental protection and promoting good agricultural practices. Researchers and scientists are however seen to face barriers from national strategies promoting intensive practices, overexploitation of resources (mainly water) and excessive use of chemical fertilizers, and the lack of government awareness on the benefits of agroecology. It is considered that policymakers and programs focus instead on intensive measures and emergency decisions aimed at quickly achieving defined goals, which may conflict with the long-term nature of the agro-ecological process. No interviews were conducted with officials in Algeria to support these observations.

- Case of Mauritania

In Mauritania, agroecology is slowly gaining recognition, primarily through the efforts of NGOs. Firstly, interviews with farmers show that they are familiar with agroecology, mainly by the means of transferred learning originating from NGOs. Relevant practices they apply include the use of organic matter, natural treatments, crop rotation, and water management. Obstacles that farmers noted include the need for technical support and

extension services / advice, and their perception that agroecological production requires more resources, energy and patience. Indeed, interviews with NGOs show they are actively working with international organizations in environmental preservation and are gradually introducing the concept and practices of agroecology through their activities. Although no interviews were conducted with researchers in Mauritania, interviews with government officials show that the concept of agroecology is known at central level at the Ministry of Agriculture but not at the level of local technical services. It was also interesting to see how it was recognized at the ministry level that agroecology is not taken into account in current strategies and policies and that programs and projects on agroecology are instead the work of cooperation and international organizations. In their perspective, obstacles at the level of local technical services include little knowledge of agroecology which is mentioned in the public policies only from technical angles of natural resource management (water, land, biodiversity, etc.). Additionally, it was reported by representatives of government officials that as the needs of the population are not met by local production, the priority remains to ensure self-sufficiency in vegetables, after which agroecology can be thought about. Furthermore, technicians lack training, and financial, logistical, and human resources are insufficient for continuous farmer support.

Box 15: Main conclusion points for the perception of agroecology with interviewed stakeholders

Main conclusion points

From the above observations, it becomes evident how the perception of agroecology across North Africa varies widely among different countries and stakeholder groups. Although there is a general interest in agroecological practices, whether for their environmental benefits or by means of regular adopted habit, certain significant barriers exist for its wider adoption. These include mainly weak access to technical knowledge, financial risks, and political support. Farmers often lack the resources and advice needed to transition, while researchers and officials cite the need for better funding and integration of agroecology into national policies. NGOs are seen to play a crucial role in promoting agroecology and especially when they are linked to international cooperation projects that are at the source of introducing and stimulating such approaches.

The below points summarise what can be commonly observed and concluded for every type of stakeholder.

- Farmers

The awareness and adoption of agroecology among farmers in North Africa is notably limited. The knowledge of agro-ecological practices is particularly underdeveloped with a significant disparity observed between small to medium-sized family farms and larger commercial farms. In smaller farms, especially those that are family-owned, there is a certain adoption of agro-ecological practices which varies by region. Common practices include the use of manure, crop rotation, and the integration of livestock with agriculture. However, these methods are often employed more out of necessity than choice, driven by the limited resources available to small farmers. On the other hand, larger farms, particularly in Egypt and Morocco, tend to favour intensification practices aimed at maximizing output. This approach is aligned with broader national agricultural policies that prioritize productivity and food security. Furthermore, in countries like Algeria, the perception of agroecological practices as cost-saving alternatives is overshadowed by concerns over

resource limitations. Farmers fear that adopting these practices might lead to diminished returns and lower incomes, compounded by the lack of adequate support to mitigate these risks.

- Researchers

Among researchers, there is a general awareness of the concept of agroecology, but it is not considered a research priority. This is primarily due to two reasons; the prevailing national policy directions and the constraints imposed by limited research budgets. Despite this, there are specific technical research topics related to agroecology being explored in countries such as Egypt, Morocco, and Tunisia. These research efforts, however, are fragmented and lack a cohesive strategy, often leading to debates and disagreements among researchers about various components and practices of agroecology such as in Egypt and Morocco. The scientific knowledge base on agroecology is not well-developed across different national contexts in north Africa. This lack of a robust scientific foundation is further exacerbated by the absence of specialized scientific skills needed to advance agroecological research. As a result, the potential benefits of agroecology remain underexplored and underutilized in the region.

- NGOs and Professional Organizations

Non-governmental organizations working with international donors and through international cooperation are familiar with agroecological concepts and actively engage in related activities. Through their initiatives, NGOs are instrumental in raising awareness and demonstrating the viability of agroecology among farmers. However, the scope of these activities is typically limited and experimental. This is largely due to the lack of an accumulated body of scientific knowledge to substantiate and support these efforts. Consequently, while NGOs contribute significantly to the dissemination of agroecological practices, their impact remains constrained by the experimental nature of their projects and the insufficient scientific backing.

- Representatives of Public Authorities

Public authorities, including ministries and other governmental bodies, exhibit a vague understanding of agroecology. The primary focus of these entities is on meeting immediate food security needs and ensuring sustainable agricultural productivity. In this context, intensification is viewed as the key strategy, with efforts directed towards optimizing resource management. For instance, the implementation of water-saving irrigation methods in Egypt, Morocco, Tunisia, and Algeria is aimed at expanding irrigates areas to enhance agricultural output. The emphasis on intensification aligns with national objectives of maximizing resource exploitation to achieve food security. As a result, agroecology, which often emphasizes sustainability and resource conservation over short-term productivity gains, does not receive significant attention or support from public authorities.

PART 3

National Country Reports

Chapter 5

National Report for Algeria

Amel Bouzid, Fatah Ameur, Karima Boudedja, Amine Oulmane, Aissa Belhadi (CREAD)

Ali Daoudi, Sami Assassi, Manel Nechar (ENSA)

PART 3: NATIONAL COUNTRY REPORTS

Chapter Five National Report for Algeria

5.1. Introduction

Since gaining independence, agricultural policies implemented in Algeria have constantly aimed to increase agricultural production, with the aim of reducing dependence on imports and guaranteeing food security. However, it is clear that several obstacles, whether climate, institutional, organizational, technical, economic or social, hinder the achievement of this objective. Among these challenges, climate change, as well as soil degradation and loss of fertility, are having a significant impact on the agricultural sector (Omari et al., 2012).

Climate change is a growing threat, with unpredictable variations in weather, droughts, floods and other extreme weather events that can compromise agricultural yields. This climate change requires constant adaptation of agricultural practices to mitigate adverse effects on production.

At the same time, land degradation is a major challenge. Erosion, overexploitation, intensive use of chemical fertilizers and other unsustainable agricultural practices contribute to the decline in soil fertility. This degradation undermines the ability of the land to sustain productive agriculture in the long term.

In addition, institutional and economic barriers, such as limited access to resources, low agricultural technology, marketing problems and social inequalities, also impede sustainable agricultural development.

To overcome these challenges, it is essential to implement holistic and sustainable agricultural policies that take into account environmental, social and economic aspects. This could include measures such as promoting environmentally friendly agricultural practices, investing in agricultural research and development, improving access to resources for farmers, and putting in place mechanisms to manage climate-related risks. Moreover, close collaboration between government, the private sector and civil society is crucial to develop sustainable and inclusive solutions to these complex challenges.

5.2. Background

As a result of these challenges, although the agricultural sector currently accounts for **14.3%** of GDP, with an added value of **2546.9 billion Algerian dinars** according to the National Statistics Office (ONS), dependence on imports remains a major concern. This mainly concerns strategic products such as **cereals, milk and oils**.

Box 1. **Synoptic data on Algerian agriculture.**

- ✓ Utilised agricultural area: **8.6 million ha (6 million ha private land)**
- ✓ GDP-$171.8 billion
- ✓ Agricultural GDP**: $21.23 billion**
- ✓ GDP IAA**: $3.73Billion**
- ✓ Number of farms: **1,260,000 farms;**
- ✓ Agricultural employment: **2.6 million employees**, or nearly **20%** of the working population
- ✓ Cereal area**: 3.3 million** ha more in 2021, including 500,000 ha in the south
- ✓ Production 3.3 million tonnes

As the increase in food demand cannot be met by local supply, imports are therefore crucial to meet the country's food needs. The food bill has been growing continuously in recent decades. Imported products contribute 55% of the calories consumed by Algerians, which ranks Algeria in the top ten of the largest food importers in the world.

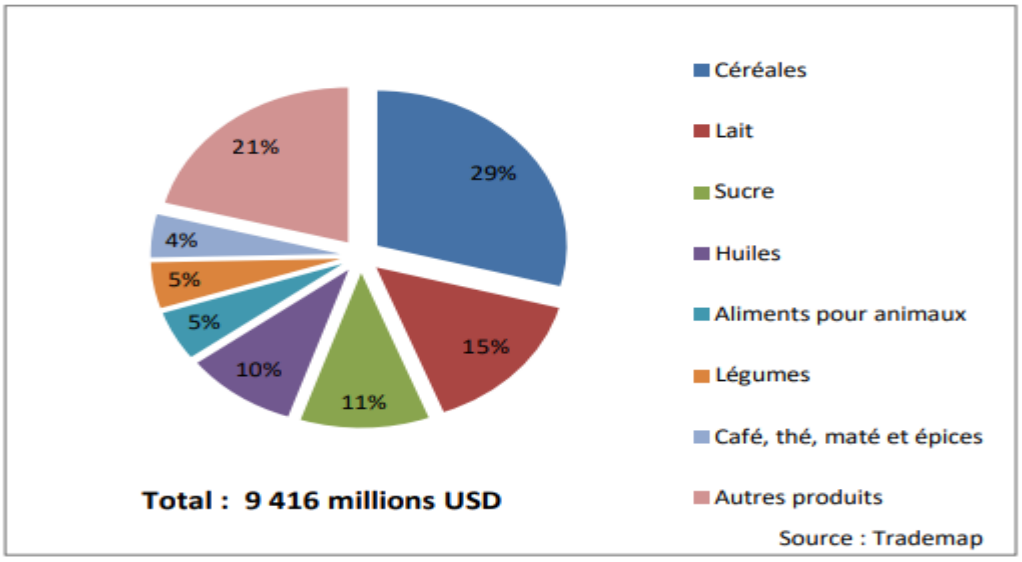


Figure 8: Imports of agricultural products by product.

Source: Bessaoud et al., 2019

In addition, attempts to intensify agricultural production have had consequences for production ecosystems. This has resulted in an expansion of vegetable and cereal crops towards steppe and Saharan regions. This is largely due to pressure on land and water resources in the northern irrigated plains.

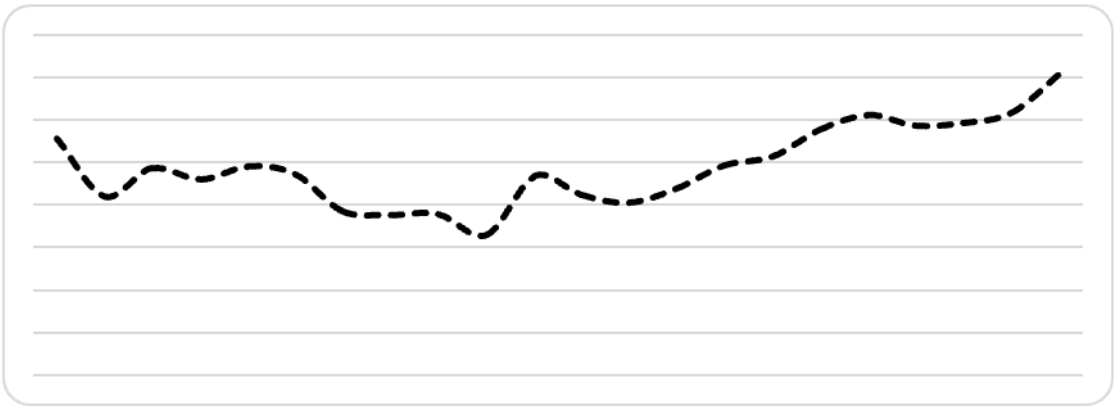


Figure 9: The share (in %) of agriculture in GDP in Algeria.

Source: World Bank in Adair et al,. 2022

Agriculture plays a crucial role in Algeria's economy. In terms of direct contribution to Gross Domestic Product (GDP), it increased from less than 10% between 2005 and 2008 to 14.7% in 2022. However, this contribution varies considerably from year to year depending on climatic conditions and the influence of several macroeconomic factors, such as government policies, investments in the agricultural sector, fluctuations in the

prices of agricultural products on world markets, as well as factors related to domestic demand and agrarian structures.

5.3. The State of Natural Resources

5.3.1. The nature of the landforms

Algeria is the largest country in Africa and covers an area of 2,381,741 km2. The Sahara covers more than 87% of this territory, or more than 2 million km2, while arable land represents just over 3.5% of this area, or 8.59 million hectares. The major challenges of agriculture in Algeria therefore lie in the nature of the relief and the bioclimatic conditions.

According to Bessaoud et al (2019), the agricultural territory in Algeria can be divided into four distinct groups

- The coastline and mountain ranges, occupying 4% of the total area. Although these regions account for one third of the country's cultivated land, the utilised agricultural area in mountain areas is estimated at 1.7 million hectares, or 20 per cent of the national utilised agricultural area. In these mountainous regions, characterized by steep slopes defining agricultural areas, the population, mainly focused on livestock, practices this activity in addition to agriculture.
- The interior highlands and high plains, covering about 9% of the total area, play a significant role in hosting nearly two-thirds of the cultivated land. These regions are characterized by harsh climatic conditions, marked by drought and aridity, with a dry and cold climate.
- The steppes, located between the Tellian Atlas to the north and the Saharan Atlas to the south, cover an area of 30 million hectares. The semi-arid climate dominates and poor soils characterize these regions where sheep farming occupies a central place, practiced both extensively and sometimes more intensively with imported feed. This pastoral activity remains the essential element of the local economy, significantly influencing the life and resources of these vast steppe areas.
- The Sahara, an arid desert covering 87% of the country, has extreme climatic conditions with an average annual rainfall of less than 100 mm. Although the land is poor, land reclamation policies, favoured by the importance of the particularly deep aquifers, have led to the rapid growth of Saharan agriculture.

Most of the country's agricultural territory is located in arid and semi-arid areas, accounting for 85% of the total land area (excluding the Sahara) and hosting 60% of the agricultural population. Average rainfall is 89 mm/year, with potential evapotranspiration ranging from 800 mm in the northeast to more than 2,200 mm in the southeast, reflecting the scarcity of land in humid or sub-humid bioclimatic zones.

Water resources in Algeria generally fall into three distinct categories. First, there are renewable surface water resources, which are estimated at around 10 billion cubic meters per year for the entire country, including the Sahara. Despite its vast expanse, the Sahara contributes only a potential of 0.2 billion cubic meters. Then there are the renewable groundwater resources, totalling about 2 billion cubic meters per year, mainly in the aquifers in the north of the country, fed by rainfall. Finally, there are the groundwater resources of the Continental Intercalaire and Terminal Complex aquifers, located in the south of the country. These two large deep aquifer

systems are marginally not renewable, which makes them particularly fragile and requires extremely careful management to ensure their sustainability. The potential of these aquifer systems is estimated at 40,000 billion cubic meters.

Being located in a water-scarce region of North Africa, Algeria is likely to experience more prolonged drought periods in the future, due to the threats posed by climate change in the region.

This lack of available resources is further exacerbated by several factors:

- The unequal spatial distribution of water resources.
- Erosion and siltation of dams.
- Losses due to obsolescence of distribution networks and lack of management, servicing and maintenance.
- Pollution phenomena.
- Inadequate catchment infrastructure.
- The high costs of investments needed to mobilize and transfer water resources.

These complex challenges require prudent and effective management of water resources, as well as sound investments in infrastructure and management practices to ensure water security and meet the growing needs of the population.

Since the early 2000s, the national strategy for the development of the water sector in Algeria has been strengthened in its objectives, which had already been established since the 1980s. These objectives include:

- Securing the supply of drinking water for the population.
- Contribute to improving food security by making more water available for agriculture in order to increase irrigated areas.

To achieve these objectives, the national water strategy has been integrated into the national spatial planning plan. It has defined programmes to mobilise new water resources and organise transfers to the most disadvantaged areas in terms of water resources, with the aim of helping to rebalance the territory. This strategy gives priority to the sustainable development of the Highlands and the South. The mobilization of additional water volumes also includes the exploitation of unconventional resources, including seawater desalination.

To achieve this strategy, Algeria has invested heavily over the past three decades to make up for lost time. These investments have led to a significant increase in the number of dams and reservoirs, as well as the establishment of infrastructure for inter-regional transfers. They have also led to the proliferation of treatment plants and supply networks to meet the growing demand of all users.

Algeria has 80 dams with a total capacity of 8.3 billion cubic meters and 575 reservoirs with a capacity of 206 million cubic meters for the mobilization of conventional water

Irrigation is practiced on 27 large perimeters, covering a total area of 227,500 hectares. This practice uses both surface water and treated wastewater. In addition, irrigation is carried out from surface water collected by small dams, hill reservoirs, run-of-river withdrawals and boreholes to extract groundwater.

In fact, the area actually irrigated increased from 350,000 hectares in 2000 to 1053,000 hectares in 2013, and exceeded 1.5 million hectares in 2023. This significant expansion was made possible from 2001 onwards thanks to small- and medium-sized hydropower developments and subsidies to the irrigated sector.

Table 14: Evolution of irrigated areas in Algeria (Ha)

2000/2001	2002/2003	2007/2008	2010/2011	2012/2013	2015/2016	2016/2017	2022/20023
350 000	644 978	905 293	981 736	1 053 523	1 260 508	1 301 213	1 500 000

Source: MADR

5.3.2. The main agricultural products

Agro-climatic constraints in Algeria force farmers to adopt extensive cropping systems in rainfed farming areas. In 2020, more than half of the Usable Agricultural Area (UAA) was dedicated to field crops, mainly cereals. With more than a third of the national UAA (37.3%) fallow, the cereal/fallow system accounts for more than 80% of the total UAA and covers almost 60% of farms.

Cereals dominate in the semi-arid zones of the Tellian High Plains, the sub-arid areas of the Highlands, and the humid and sub-humid zones of the littoral and sub-littoral regions. Arboriculture, covering just over 10% of the UAA, focuses on plantations of olive, fig, date palm, and fruit trees.

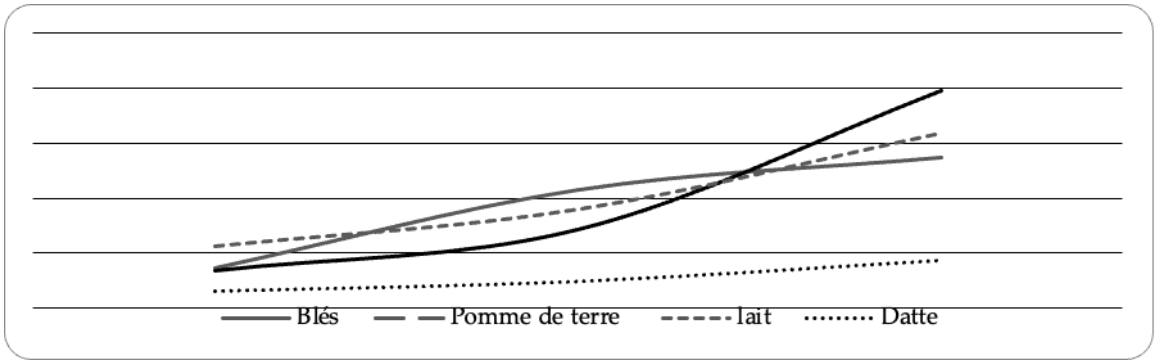


Figure 10: Production of the main agricultural sectors (1990-2017). *Note: These are ten-year averages of agricultural production in thousands of tonnes.*

Source: FAOstat (2021)

The quantitative evaluation of previous agricultural policies (1990-2017), based mainly on the principle of intensification and price support, is positive and agricultural production has gradually increased for almost all sectors.

Table 15: Legal status of land in Algeria

Ownership	Farms	Area	Average
Melk Lands	777 323 (75,92%)	5,857,212 ha (69,24%)	7.5 ha

Private domain of the State*	186 622 (18,22%)	2,566,199 ha (30,33%)	13.75 ha
Mortmain (hAbous private)	2 211	24,056 ha	10.88 ha
Mortmain (hAbous public)	605	4,821 ha	7.96 ha
Other	57 038	6,392 ha	0.11 ha
Total	1 023 799	8,458,680 ha	8.2 ha

*Note: *concessional. Source: RGA 2001*

Market gardening occupies about 5% of the UAA.

In the oases of the South, farmers cultivate date palms, market gardening and fruit trees, sometimes using ancient techniques such as foggaras, developed as early as the eleventh century.

Analysis of agricultural data reveals that about 70% of farms have an area of less than 10 hectares, thus occupying more than a quarter of the Utilised Agricultural Area (UAA). Intermediate-sized holdings, covering an area of 10 to 50 hectares, hold about 51.8% of the total UAA and account for 22.6% of the total number of holdings. These conclusions are drawn from the last General Census of Agriculture (RGA) in 2001, which recorded nearly 1.2 million farms.

5.4. Constraints and challenges

5.4.1. Climate change and threats

Algeria has experienced a succession of periods of drought, profoundly marking the climatic landscape of the region. These phases of water deficit have had a significant impact on the availability of water resources, exacerbating long-standing water management challenges. Recurrent droughts have not only affected natural water resources, but have also had direct implications on agriculture, the ecosystem and the daily lives of citizens.

Over time, these periods of drought have placed significant pressures on Algerian decision-makers, forcing them to take adaptation measures and rethink water management policies.

The modes of governance adopted for irrigation water governance around the world are mainly motivated by the fight against climate change, which is causing water scarcity situations that are increasingly distant from the needs of populations and WHO standards (Alstom, 2016).

The issue of access to water, which is universal and complex, requires a collaborative approach to address the diversity of uses and users (Biswas & Tortajada, 2010). The search for sustainable solutions involves consultation between actors with sometimes divergent interests. The need to reconcile diverse demands requires the establishment of strategic partnerships, thus promoting a balanced and appropriate management of water resources. In this context, the construction of thoughtful compromises and the creation of cross-cutting alliances are essential levers to overcome water-related challenges, thus ensuring equitable and sustainable access to this vital resource for all.

In 2003, the Algerian public authorities launched an emergency programme to guarantee the supply of drinking water to the urban areas of the Algerian region. This action plan focused on the installation of seawater desalination units, a major initiative to respond quickly and efficiently to the growing water needs in the country's largest metropolis (MRE, 2021)

Currently, Algeria has 14 operational seawater desalination plants, a number that is expected to increase to 19 with the commissioning of projects planned from the year 2024. These facilities play a critical role in providing about 17% of the water consumed in the country. With a total capacity of 2.6 million cubic metres per day, they make a significant contribution to meeting the drinking water needs of around 6 million people. This expansion of desalination capacity is a testament to Algeria's continued efforts to diversify its water supply sources and address challenges related to the availability of this crucial resource.

Other initiatives have been implemented to improve the use of water resources, strengthen agricultural resilience and develop climate-smart infrastructure. One of these public initiatives is the program to support farmers for the installation of drip irrigation systems. This modern and efficient technique allows for targeted use of water, reducing losses and promoting more precise irrigation management.

Algeria has decided to prioritise food sovereignty, aiming for a significant increase in national agricultural production, particularly in key sectors such as cereals, dairy production and potato cultivation. To achieve this vision, Algeria aims to expand its irrigated agricultural area to 2 million hectares, thus mobilizing 12 billion cubic meters of water, compared to the 7.20 billion cubic meters currently mobilized each year, which comes (83%) from groundwater, dams and reservoirs (8%) intended mainly for large irrigation schemes, and (2%) from flood spreading, ponds and the reuse of treated wastewater (7%) and the exploitation of watercourses (7%).

Of the 18 billion m3 of water potential, 12 are in the north and 6 in the south of the country (Ministry of Water Resources, 2021).

5.4.2. Anthropogenic pressures and degradation of natural resources (land, water and biodiversity)

Climate change has multiple impacts on the environment, and consequently on agriculture. First of all, it has a negative impact on the availability and quality of water. In addition, it leads to an increase in the frequency of extreme weather events, which worsens land degradation. This degradation is already a cause for concern, as it leads to a decrease or even disappearance of the initial biological productivity potential of cropland, rangeland, pasture and forest.

In addition, areas deforested following fires (Boumerdès, Bouira, Tizi Ouzou, Bejaïa, Jijel) in recent years are even more susceptible to erosion, which exacerbates soil degradation. This degradation limits the possibilities for groundwater regeneration and accelerates the siltation process of reservoirs and dams built to build water reserves.

5.4.3. Agro-climatic and technical constraints

Agriculture in Algeria has always faced major challenges related to climate risks. Quantitative evaluations of past agricultural policies, mainly focused on intensification and price support, have generally been positive.

They have led to a gradual increase in agricultural production in most sectors. However, this trend is marked by two distinct realities. First, the evolution of production is very irregular, with growth rates ranging from -4.6% to 25%, largely dependent on rainfall. Second, there is a large negative lag between the growth rate of agricultural production and that of domestic food consumption. This is because consumption, or food needs, grow twice as fast as production, which often leads to this gap being covered through imports.

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5.4.6. Food dependency and the extent to which nutritional needs are met by national production.

Between 2015 and 2019, agricultural imports reached an average annual amount of US$7.42 billion, mainly dedicated to food products. Of this amount, 57.8% was allocated to imports of agro-industrial products such as durum wheat, soft wheat, vegetable edible oils and soybean meal.

Table 16: Share of food imports/availability of selected products.

Product	Avg 1990-1999	Avg 2000-2009	Avg 2010-2019
Wheat	**62**	**82**	**83**
Barley	29	25	37
But	91	100	100

Potato	14	8	3
Sugar	**97**	**100**	**100**
Vegetable Oils	**80**	**100**	**100**
Tomato	8	7	14
Milk	**61**	**56**	**42**

In 2019, there was an 8% decrease compared to the average agricultural imports over the period 2015-2019, representing a reduction of more than US$800 million in value. The breakdown of this decrease is as follows:

A reduction of more than $500 million in food imports.

A decrease of more than $300 million for non-food products such as seeds, fertilizers and live animals

The current situation shows a structural deficit in so-called commodities. On an annual average over the period 2010-2019, national production covers only a small number of needs: 10% of common wheat and 50% of durum wheat, 0% of oil (excluding olive oil), and 58% of milk. For market gardening products, there is a certain self-sufficiency in terms of production, but a strong dependence on fertilizers and seeds.

It should be noted that over the past twenty years, there has been a significant increase in expenditure on the import of strategic food products, especially cereals, milk and oils. In 2000, this expenditure amounted **to 204 billion Algerian dinars**, then it reached **522 billion dinars** in 2010 and finally rose to **1026 billion dinars in 2020.**

5.4.7. Crisis in global markets

The persistent choice of public authorities to keep food prices low has led to a structural imbalance between local supply and food demand. This disparity has widened over time, spurred by persistently high population growth and food purchasing power supported by low prices, particularly for basic necessities such as cereals, milk, sugar and vegetable oil, which are heavily subsidized (see Figure 8). Food demand has continued to grow, while the average daily food intake per capita has increased significantly, from 1577 kilocalories in the early 1960s to 3349 today.

The challenges and issues of the future:

The reclamation of land and the preservation of waters**:** increased pressure on natural resources can be a source of social conflicts over their use and uncontrolled migration.

- Rational use of natural resources (soil, water, forests, biodiversity) contributes to the construction of controlled agricultural systems and to the balance of rural territories.
- The issues at stake are also those of food sovereignty, public health and dignified living conditions.

5.5. Strategies Adopted

5.5.1. The agricultural strategy

In 2020, the government adopted a roadmap for the period 2020-2024. The agricultural policy orientation of this roadmap emphasizes the promotion of the green economy, thus underlining the importance of rational management of natural resources. This orientation aligns with and is similar to the objectives of the first incremental level, among the five levels of the agroecological transition proposed by Gliessman (2007). This vision has been achieved through the implementation of sprinkler and drip irrigation systems, covering nearly 939,200 hectares, or 64% of the total irrigated area, which reaches 1,473,919 hectares.

As part of the commitment to sustainable development, the agricultural sector has been actively promoting the adoption of renewable energy on farms in the highlands, steppe and south since 2020.

Significantly, the new sector strategy integrates the forest sector, thus playing a crucial role in diversifying the economy and increasing the incomes of rural populations through the creation of green jobs.

At the same time, an extensive programme for the development of hardy species, such as carob trees, argan trees and almond trees, has been launched to strengthen the resilience and sustainability of the sector.

To achieve its development plan, the sector has made the strategic decision to rely on the academic world as a key partner. This collaboration aims to promote innovation and research, with a particular focus on the development of organic fertilizers and pesticides, as well as innovative technological solutions. This collaborative approach strengthens the link between academic research and the concrete needs of the agricultural sector, thus contributing to more sustainable and resilient growth.

5.5.2. Green Dam Rehabilitation Plan

The Green Dam is a large-scale agroecological project aimed at afforesting three million hectares over an area of 1500 kilometres, mainly in the Algerian steppe. Launched in 1970, this project was designed to counter the encroachment of the desert in Algeria, initially focusing on the renewal of the country's forest heritage, threatened by desertification and human activities.

The project covers 13 Algerian wilayas, where many operations are planned between 2023 and 2030. The implementation is jointly supervised by the Forest Conservation and the Agricultural Services of the wilayas concerned. A substantial budget of 75 billion Algerian dinars has been allocated to finance reforestation operations and the fight against desertification.

The planned actions include the reforestation of 17,000 hectares over a seven-year period, as well as other development initiatives to restore the Green Dam. This program will be deployed in coordination with 183 municipalities in 13 wilayas, over several stages, with a first phase covering the period from 2023 to 2026 and an initial budget of 10 billion Algerian dinars.

Under this budget, 13% of the rehabilitation operations will create more than 10,000 jobs and reduce 2,000 tonnes of carbon. The Public Group for Rural Engineering (GGR) and the National Bureau of Studies for Rural Development (BNEDER) will be responsible for the first phase of implementation.

The operations entrusted to the GGR will benefit from a financial envelope of more than 9.3 billion dinars, dedicated to the planting of 18 million trees. These initiatives will include the reforestation of forest areas with a focus on planting plant species of high economic value, such as argan, carob tree, pistachio tree, prickly pear cactus, as well as various medicinal and aromatic plants. At the same time, socio-economic surveys will be carried out to identify farmers' needs in terms of fruit plantations, assess the unemployment rate, and promote investments through micro-enterprises that can be envisaged at the level of these wilayas.

The authorities, through the Ministry of Agriculture and Rural Development, have also established partnerships with laboratories and processing units for the extraction of oils. This approach aims to involve rural women and enhance their expertise in the process. Thus, in addition to environmental aspects, these initiatives integrate a social and economic dimension, aiming to strengthen local communities and promote sustainable agricultural practices.

In addition to these actions, work will be undertaken to create a green strip on 929.5 hectares and stabilize the dunes on 1129.5 hectares. Particular attention will be paid to water and soil conservation, aiming to ensure the protection of 30,100 cubic metres of this vital resource.

5.5.3. The National Wetlands Strategy

The Directorate General of Forests has developed the National Wetlands Strategy 2015-2030, with the support of the World Wide Fund for Nature (WWF), involving all the actors concerned by the issue of wetlands, including associations, through a multisectoral National Committee in charge of Wetlands, set up by the ministerial decree of 20 March 2012 (OJ No. 47).

This strategy is an instrument to support all sectors for the sustainable management of wetlands, making it possible to contribute to the fight against desertification, as well as adaptation to climate change, the mitigation of its effects and the protection of the country's water resources.

The different axes of the strategy are also correlated with the targets of the MedWet Framework for Action 2016-2030, in particular in terms of the inscription of new sites on the Ramsar List, the development and implementation of restoration projects for degraded sites, as well as the integration of good practices for water management and wetland conservation into national land use policies and plans, in order to avoid attacks on their functions and values.

The strategy was carried out in a fully participatory manner, resulting from a joint contribution of several multilateral cooperation actors, such as the Ramsar Convention, the World Wide Fund for Nature (WWF), and the United Nations Development Programme (UNDP) in Algeria.

5.5.4. Environmental strategies based on official documents

Algeria has put in place institutional, legislative and technical mechanisms to ensure the protection of the environment and the rational management of natural resources, and to orient socio-economic policies towards sustainable development. Since the Johannesburg Summit in 2002, Algeria has stepped up its actions in these areas, thus placing social and ecological aspects at the heart of its choices for a social model (RADP, 2011).

Since its independence, Algeria has ratified some twenty international conventions and protocols in the field of sustainable development. These agreements include ten conventions on the protection of the sea, nine conventions on the protection of living natural resources, five conventions on the protection of the atmosphere, one convention on combating desertification, and one convention on the control of hazardouswastes (Demri, 2010).

The basic law that governs environmental issues related to sustainable development is Law No. 03-10 of 19 Jumadha El Oula 1424, corresponding to 19 July 2003, on the protection of the environment within the framework of sustainable development (JORADP, 2003). This law repealed Law No. 83-03 of 5 February 1983, which focused exclusively on environmental protection.

The 2003 Act sets out several objectives, including:

- Improve the level of food security through agricultural production.
- To ensure a controlled evolution of the organization and management instruments of the agricultural sector, promoting the increase of its productivity and competitiveness while guaranteeing the protection of the land, the rational use of water for agricultural purposes, as well as the preservation of its productive potential.
- To put in place a legislative framework that favours the evolution towards economically and socially useful and ecologically sustainable agriculture, and that promotes the participatory approach in order to encourage the voluntary support of partners in the State's efforts for the development of all areas, while ensuring the enshrinement of social protection rules and the promotion of the rural environment.

5.5.5. National Biodiversity Strategy and Action Plan 2016-2030:

The design of the National Biodiversity Strategy and Action Plan (NBSAP) was led under the aegis of the Ministry of Environment and Renewable Energies (MEER) with the aim of developing a vision and actions on biodiversity in Algeria. Although Algeria's biodiversity is exceptionally rich, it faces various man-made and climate-induced pressures. Challenges include a lack of awareness among the general public, insufficient intersectoral coordination in the sharing of diagnostic tools and data, as well as difficulties in implementing existing legislation, including due to limited human and budgetary resources.

The resources currently allocated to biodiversity are considered insufficient, resulting in an obvious loss of income for the country's economy. Biodiversity, however, can be a driver of sustainable economic and social development, thus constituting the central axis of this strategy. The benefits of sustainably managing, enhancing, conserving and restoring natural ecosystems include the creation of sustainable jobs and improved incomes for the Algerian population, especially young citizens.

The NBSAP is structured around four strategic directions:

A. Adaptation of the institutional, policy and legislative framework,

B. Development, sharing and valorization of knowledge and knowledge for inclusive sustainable development,

C. Conservation and restoration of Algeria's natural capital,

D. Valuing biodiversity for the green economy.

In total, NBSAP has 21 objectives and 113 actions, with an estimated budget of more than US$100 million to begin its implementation.

Among the key measures of the NBSAP 2016-2030, the following actions can be highlighted:

- The establishment of a network of protected areas;
- The creation of a Biodiversity Observatory coupled with an early warning system;
- The establishment of an annual national conference on biodiversity;
- The development of a national ecological compensation mechanism;
- Revision of the statutes of existing state structures (e.g. CNDRB, National Parks, etc.);
- Experimentation with innovative financing mechanisms (Payments for Ecosystem Services, pricing at the entrance to National Parks, etc.);
- The development of ecotourism.

5.6. The Main Guidelines for Research and Training

5.6.1. The White Paper on Food Safety

Developed by the Directorate-General for Scientific Research and Technological Development (DGRSDT) in 2019 compiles a comprehensive analysis of research activities. It provides a comprehensive overview of national research programmes (NRPs), research projects at the level of institutions under the Ministry of Higher Education and Scientific Research and other sectors, as well as international research projects. Researchers and experts actively participated in meetings organized by DGRSDT, during which significant recommendations and lines of research were formulated.

This strategy paper aims to provide a comprehensive view of advances in food security, identifying key areas of research and offering perspectives for the future. The recommendations made by researchers and experts at these meetings are likely to play a crucial role in guiding future policies, programs and initiatives related to food security.

5.6.2. La National Cereal Production Development Strategy (2023)

As part of this study, three strategic axes have been defined to address the main concerns of the sector. These axes aim to improve cereal production and productivity, improve seed quality, and reduce environmental impacts while aiming for self-sufficiency in cereal production. On this basis, a development plan was drawn up, comprising seventeen operational objectives and several concrete actions. This approved strategic plan covers a period from October 2023 to June 2028. It aims to guide collective efforts towards achieving these objectives, thus contributing to the strengthening and sustainability of the cereal sector.

Agroecology skills generally fall into two main categories: scientific skills and technical skills. As far as vocational training is concerned, no training in agroecology is provided outside the university setting. The courses of this speciality are divided into four distinct formulas. First of all, the specialized courses, present in some masters of the ecology and environment specialty, offer a succinct approach to agroecology, often reduced to a simple

module without in-depth technical details. In addition, LMD degree courses consist of 11 programs in Algeria, although some are still in the validation phase, due to the immediate lack of supervisory capacities. At the master's level, only six courses are available in all the country's universities and colleges, with start-up difficulties related to the complexity of launching new master's degrees and the provision of the necessary logistics. Finally, a single Ph.D. is provided at a university in the south, in Biskra, in collaboration with CIRAD Montpellier. This PhD, entitled "Agroecology and Pastoralism in Arid Zones", focuses on dryland-specific agroecology, in relation to local livestock systems and pastoralism in the Biskra region. It is essential to emphasize that the curricula taught are largely inspired by ecology modules, with limited incorporation of concepts directly related to agroecology. In addition, the similarity between the master's curricula and the published programs, as well as the non-publication of the majority of the programs by the universities and departments providing agroforestry training, are notable aspects to consider.

5.7. Analysis of the Strategies Adopted and the Role of Agroecology

5.7.1. The dynamics of agricultural growth in the main branches of production, with reference to capacity expansion.

Agricultural production has increased gradually in almost all sectors since the introduction of intensification programmes in the early 2000s as part of the National Agricultural Development Programme (PNDA). Increases have been noted, particularly in the basic sectors (cereals, milk, potatoes, fresh vegetables, dates, etc.). However, population growth and the improvement in living standards mean that meeting needs depends on imports for basic consumer products (wheat, milk, oils) and on imports of inputs (seeds, phytosanitary products, etc.) for other products (potatoes, arboriculture, market gardening). In the documents of the economic recovery plan for the period 2020-2024 and the roadmap of the Ministry of Agriculture and Rural Development (MADR), future forecasts claim increases in the local food supply but without taking into consideration the future evolution of the population or its geographical distribution.

The results achieved in Algeria in terms of agricultural intensification are attributable to the programmes implemented during different periods, including the National Plan for Agricultural and Rural Development (2000-2007), the Agricultural and Rural Renewal Programme (2008-2014), and the ongoing initiatives of the period 2015-2019. The aim of these programmes is to increase production and productivity while integrating various sectors, including cereals, raw milk, pulses, potatoes, olive growing, industrial tomatoes, arboriculture, phoeniciculture, red meat and poultry farming.

The actions undertaken include the generalization of water-saving systems, the development of feed resources for livestock, the production of seeds, seedlings and broodstock, as well as mechanization and fertilization, while strengthening the managerial capacities of the actors involved. During the Agricultural Renewal Programme (2010-2014), an envelope of 600 billion DA over five years was allocated, mainly for the modernisation and intensification of production chains, the direct incentive for production of certain crops, and the development of systems for regulating and protecting farmers' incomes.

These initiatives cover all segments of production, and the necessary inputs are covered by local production and imports. For seeds, there is a local production of 3 million quintals in 2019, with a forecast of 32% evolution

for certified seed in the current program (2020-2024). With regard to fertilizers, Algeria, which produces fertilizers using locally available raw materials, plans to increase the area fertilized, especially for cereals, by removing certain restrictions and offering 20% subsidies to farmers for the acquisition of fertilizers. These measures are intended to support agricultural objectives, including the achievement of 2 million hectares of cereals out of the 3.3 million hectares of cultivated land.

5.7.2. Place given to agroecology in agricultural strategy papers

The agricultural strategy seems to be geared towards promoting environmentally friendly and sustainable farming practices. Although the term "agroecology" is not specifically mentioned, it seems to be an integral part of this approach, particularly through the use of concepts such as sustainability and organic farming.

This focus on sustainability suggests a concern for preserving natural resources, reducing environmental impacts, and creating resilient agricultural systems. The use of the term "organic farming" emphasizes the importance given to production methods free of synthetic pesticides and chemical fertilizers, which are characteristic of the agroecological approach.

Beyond the specific terms, it seems that the agricultural strategy seeks to integrate certain agroecological principles such as crop diversification, crop rotation, optimization of the use of natural resources and promotion of biodiversity. These practices contribute not only to environmental sustainability, but also to the resilience of agricultural systems in the face of climate change and future challenges.

5.7.3. Weak signals evoking or promoting agroecology in the country

Subtle signs of the promotion of agroecology are manifesting themselves in the country through various initiatives. The Ministries of Agriculture and Environment, with the support of technical institutes such as the Technical Institute of Field Crops (ITGC), are implementing programmes such as Conservation Agriculture and Seed Development adapted to the different agro-ecological zones of the country and to climate change. Although the term "agroecology" is not explicitly used, a dozen associations have been identified, testifying to the growing commitment of civil society actors. Emerging practices, such as no-till, crop diversification, agroforestry, and input reduction, indicate a transition to more sustainable methods. As far as the majority of private initiatives are concerned, they manifest themselves through spaces and online shops specialising in the sale of agroecological products, direct sales at farm level, as well as weekly markets. These developments reflect a move towards more environmentally friendly agricultural practices and reflect an increased awareness of the importance of agroecology among private actors.

Box 2. **Associations working in the field of agroecology in Algeria (Non-exhaustive list) (Leauthaud et al., in prep)**

- Association for the Protection of the Environment of Beni Isguen (APEB)
- ADHRAR (local development of the Tazla village)
- TORBA association
- JADE Environmental Ethics for Jil el mostaqbel;
- Association for reflection, exchange and action for the environment and development

- Rainbow Educational and Cultural Association
- Cultural Association for Youth and Childhood
- Association of Fig Growers of the Wilaya of Bejaïa
- Association El-Argoub

5.7.4. What are the existing skills and information in the field of agroecology?

Scientific skills (researchers, trainers, specialized department in universities or research and extension centers), technical skills (extension workers, engineers). Skills at the level of cooperatives, NGOs, private institutions, etc. etc.

Massire Project: "Integrating multiple water sources and local institutions for enhanced food security in North Africa's hinterland by reinforcing agricultural and rural innovation system".(2019-2023) This IFAD-funded international project aimed at the development of marginal areas in North Africa, is divided into three distinct phases: 1) Analysis of existing innovations; 2) Capacity building and exchanges; 3) Experimentation with innovations.

FADMA project: **"Co-constructing Sustainable Agricultural Sectors in the Maghreb"**. Mediterranean cooperation project, funded by the Occitanie region. In a context of climate, economic and health crises, food systems on the southern shore of the Mediterranean raise concerns about their fragility and resilience. Consumers, grouped together in associations or collectives in the major cities of the Maghreb, are increasingly expressing their interest in "consuming locally" and "eating healthy". At the same time, farmers are seeking to adopt practices that respect the environment and human health, but are facing a lack of income-generating opportunities. There is thus a lack of coordination between the actors of the sectors, preventing an effective meeting between consumers and producers. The FADMA project aims to improve this articulation to promote a transition to sustainable agriculture, based on diversified farms that meet local food needs. This transition is of crucial importance in the context of the scarcity of productive resources (water and land) that underpin the diet of populations, aggravated by the degradation of these resources due to certain agricultural practices. FWP projects were launched this year to map the various existing initiatives around Tunis and Algiers (the two study sites) in relation to agroecological production. The aim of these studies is to understand consumer opinions regarding agroecological products and how the market works to meet these needs. In addition to this, they explore the intrinsic behaviour of consumers towards the marketing of agroecological products. More specifically, these studies seek to assess the level of consumer support for the idea of spending more on agroecological products.

ANzAR project (2021-2023): As part of a research and development project, INAT (Tunisia), CREAD (Algeria), CIRAD and INRAE (France) organized the ANZAR forum (**multi-stakeholder forum on agroecology in the Maghreb**) held in March 2023 in Tunisia. The objective of this forum was, in a moment of conviviality, to share everyone's experiences and knowledge on agroecology while creating a network in North Africa around this subject. This forum was also an opportunity to understand how an event such as a forum can have an impact on the participants, both on the knowledge shared and on the networks of actors. To this end, questionnaires

were administered to participants before and after the forum, and an evaluation was carried out. This evaluation work is the subject of a scientific publication. We have also made two films: **Alliances for Agroecology in the Maghreb: History of a Forum** (Long and short format) which highlight the importance of such an event to equip the debate on agroecological transitions in North Africa.

Agro-Eco 4 JUGG Project (not yet launched): "Agroecology for fair and sustainable groundwater governance": The project is coordinated by DELFT's IHE (Higher Institute of Education) of the Netherlands within the framework of the Water and Development Partnership Programme (WDPP) co-funded by the Dutch government and UNESCO. The project aims to create an international learning community on wise forms of agricultural water use and management, rooted in the principles of agroecology. Focusing on water-social-agroecology interfaces, the project proposes to bring together an interdisciplinary team of researchers, activists, and practitioners from critical social sciences, engineering, hydrogeology, and soil science/agroecology. The aim is to co-learn and conduct in-depth action research projects on how to align groundwater protection and storage practices with those of soil, crop and biodiversity protection. The specific objectives of the project include the development of transdisciplinary and international collaborations around sustainable groundwater governance and agricultural food systems, the conduct of in-depth action research projects in contexts such as Palestine, India, Morocco, Algeria and Zimbabwe, and the promotion of transdisciplinary learning processes to support the development of sustainable and sustainable agricultural systems. Fair. The project also aims to develop and refine methodologies to better understand the interconnection between groundwater/irrigation, agroecology and rainfed agriculture, as well as to train young water professionals from low- and middle-income countries in the recognition and support of inclusive and sustainable groundwater governance and agricultural processes.

COSTEA Project: Agroecological Transitions in Irrigated Perimeters: The objective of the project was to promote the development of EA practices in irrigated perimeters by identifying.

In turn, the École Nationale Supérieure Agronomique is also involved in several projects that directly or indirectly focus on agroecology. These are:

- Analysis of Agricultural Innovation Systems for Food Security (2021-2024)
- Study of the dairy potential of small ruminant farms of local breeds (2021-2024)
- Valorization, conservation and management of biodiversity and natural and rural landscapes in the context of global change (2021-2024)
- Study of the genetic diversity of animal populations and possibilities for improvement (2022-2025)
- Research on grassland areas in Algeria: Importance, factors of variation in floristic composition, yield and nutritional value. (2022-2025)
- Management and enhancement of the socio-economic potential of Algerian forests (2022-2025)
- Improvement of cereal production in the face of climate change challenges in northern Algeria. (2022-2025)
- Characterization of adaptive responses and drought tolerant mechanisms of species with agronomic and environmental potential. (2022-2025)

- Study and evaluation of the genetic diversity of cultivation practices, selection methods and innovative technology to improve the resilience and adaptation of rainfed production systems (2022-2025)
- Biodiversity, valorization of natural resources and their use in the fight for sustainable development (2023-2026)
- Alternative Methods for Diagnosing and Controlling Crop Pathogens (2023-2026)
- Establishment of an agroforestry system adapted to semi-arid regions (2023-2026)
- Validation of new resilient and water-efficient food and forage legume varieties for sustainable rainfed production systems. (2022-2024)
- Rehabilitation of the fruit pistachio tree (*pistacia vera*) in Algeria. (2023-2025)
- Formulation and development of efficient rhizospheric microbiome-based biofertilizers (PGPR/Mycorrhizae): improvement of soil fertility and nutrient assimilation (2023-2025)
- Multi-agent Agri-food living labs for new supply chain Mediterranean systems; towards more sustainable and competitive farming addressing consumers
- Plant microbimes in sustainable viticulture
- Capitalizing on Mediterranean maize germplasm to improve stress tolerance
- Agroecology living labs to promote robust and resilient organic production systems
- Sustainable wasterwater Re-use with innovative purification and sensing system for agri-food supply chain.

5.8. Obstacles to Agroecology

Fertilizer use in Algeria remains relatively low, reaching about 100,000 tons per year. However, the expansion of agricultural production towards the south of the country, especially for cereals, encourages the increased use of fertilizers due to soil degradation and low nutrients. The roadmap of the 2020-2024 action plan provides for the abolition of authorisations for non-hazardous fertilising products, with the aim of increasing the fertilised areas, particularly for cereals, aiming to reach 2 million hectares out of the 3.3 million cultivated.

The Ministry of Agriculture and Sustainable Development has recently implemented an increase in the reference prices of subsidized fertilizers, in response to the global rise in the prices of these agricultural inputs and its impact on the domestic market. The measure, which came into effect on Friday, is based on a nationwide instruction detailing the new tariffs for each type of fertilizer subsidized by the state.

This decision follows the ministry's earlier announcement, increasing the reference price of fertilizers from 3,700 DA to 8,000 DA per quintal, due to the significant increase in world prices, reaching 14,000 DA per quintal. It should be noted that despite this increase, the State will continue to subsidize new prices up to 20%.

This emergency measure was taken in order to support farmers facing the financial impact of this increase in global prices. It aims to enable farmers to start the agricultural season under favourable conditions. As part of this approach, a framework agreement has been signed between the Algerian Interprofessional Cereals Office (OAIC) and the Fertilizer and Phytosanitary Products Industrial Group " ASMIDAL" to strengthen local fertilizer production and reduce dependence on imports.

In addition, the State has decided to support fertilizer prices for the 2022-2023 agricultural season by up to 50%. This new direction is intended to alleviate the financial burden on farmers. The new reference prices supported are explained in a document, where it is specified that the support rate is 50%. These adjusted rates are applicable from October 9, 2022. In addition, awareness-raising initiatives are recommended to encourage farmers to conduct soil testing. It should be noted that the rate of fertilizer use per hectare in Algeria remains relatively low, Agriculture in Algeria is characterized by moderate fertilizer use, with an average of 20.7 kg per hectare, well below the global average of 146 kg/ha according to World Bank data from 2022. In comparison, Egyptian and Chinese farmers use 473 kg/ha and 383 kg/ha, respectively.

This weighted approach to fertilizers can be interpreted as a positive measure, suggesting a potential reduction in the risks of pollution of groundwater and waterways. However, it is important to note a possible contradiction between two policies: on the one hand, the subsidy for the use of fertilizers encourages an intensification of agriculture, while on the other hand, the extension of crops towards the south of the country, due to the poverty of the soil, can lead to excessive use of fertilizers and overexploitation of water resources, in particular the Albian aquifer, through continuous irrigation.

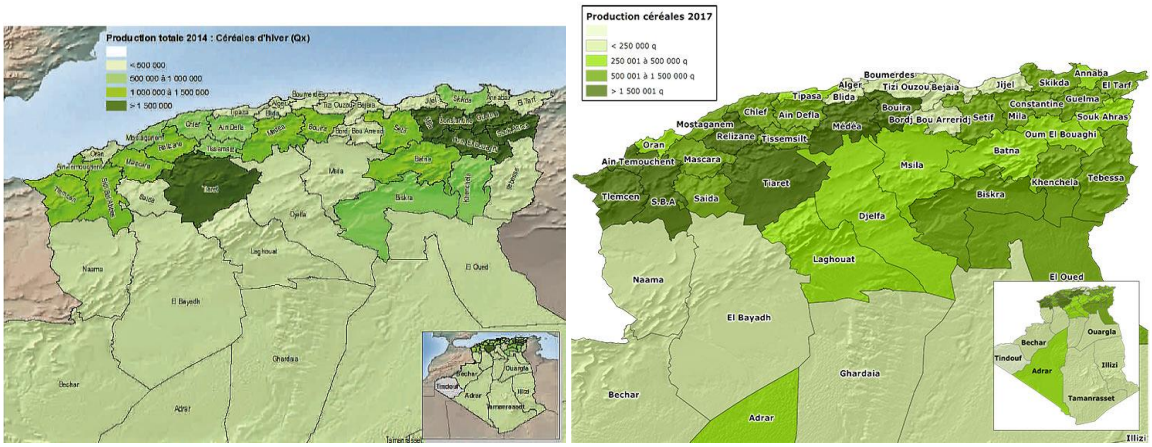


Figure 11: Extension of cereal production to steppe and Saharan areas.

Source: Series B, 2014 Source: http://madrp.gov.dz/agriculture/statistiques-agricoles/

5.9. Main Results of the Stakeholder Interview Guide

5.9.1. Methodology used

For the interviews with the actors, two distinct approaches were implemented. As part of the farmer interviews, we included specific questions on agro-ecological practices in the surveys conducted as part of the CREAD research projects currently underway in four regions (wilayas: Algiers, Constantine, Tizi Ouzou and Biskra).

At the same time, semi-structured interviews and letters were sent to representatives of the public authorities, in particular officials of the Ministry of Agriculture, researchers affiliated with various research institutes such as INRA, CREAD and ENSA, and presidents of associations. These exchanges aimed to obtain specific perspectives on public policies, research orientations, and associative initiatives related to agro-ecological practices.

Table 17: Presentation of study areas in Algeria.

	Ghardaia	Constantine	Tizi Ouzou	Biskra
Number of farmers	10	08	08	10
Average Area	30-100ha	50ha	3ha	50ha
Main crops	Grain Date Palm Market gardening Breeding	Grain Legumes	Olive growing Market gardening Breeding	Market gardening Date palm

5.9.2. Stakeholders' responses:

- Farmers:

Farmers, whether they are new to agroecology or already familiar with agroecology, frequently describe this approach using terms such as "agriculture" and "nature". This depiction suggests a well-held understanding and acceptance of the importance of agriculture in the context of nature conservation.

Various practices were identified in the different study areas, as shown in the table below.

Table 18: The different practices related to agroecology inventoried in the wilayas surveyed in Algeria.

Region	Practices
Ghardaia	Composting (date palm waste), Organic manure, Economical irrigation system (drip), Intercropping, Agroforestry (Tiered crops, oasis effect), Use of dry palms as windbreaks, combination of agriculture and livestock, use of ashes against aphids, use of lime against insects, use of fodder cabbage as nematicides, use of dried dates as fodder for livestock
Constantine	Rotation: Legumes/Cereals, Diversification Direct Seeding, Organic Manure, Fallow.
Tizi Ouzou	Intercropping, Agroforestry, Water-Efficient Irrigation System, Organic Manure, Small Plot Rotation, Crop-Livestock Integration, Crop Residue Recovery
Biskra	Composting, palm waste, Intercropping, Agroforestry, Diversification, Bunching (organic dates), Organic manure.

These practices reflect a holistic, agroecological approach that encompasses techniques such as composting and manure use to improve soil fertility, crop rotation to prevent nutrient depletion, diversification to promote biodiversity, and the use of water-efficient irrigation systems for more efficient use of resources. This regional classification provides a better understanding of the variability of agricultural practices adopted in different study areas.

The use of words such as "preserve", "respect", "soil" and "environment" highlights the crucial importance given to resource conservation and environmental protection, fundamental elements that characterize the agroecological approach.

A common concern expressed by some farmers is the perception of agroecology as less profitable due to initially lower yields, due to its association with pesticide-free and chemical-free agriculture.

These practices can be interpreted as follows:

- As an opportunity to adopt economically affordable strategies for small-scale farmers, which could be described as "agroecology of the poor".
- As a way to enter global markets for farmers operating in the organic agribusiness sector, what could be referred to as "agroecology of the rich".

- Representatives of professional agricultural organisations (cooperatives, producers' groups, chambers of agriculture, etc.)

Research in the field of agroecology is relatively limited, focusing mainly on agronomic studies

- Researchers (of different specializations):

Our survey brought together researchers working in various fields such as hydrology, agroeconomics, animal husbandry, plant science, and other disciplines...

Speciality	Agro-economist	Hydraulician	Pyrotechnician	Zootechnician	Land use planning
Number	07	02	02	03	01

Researchers specializing in this field demonstrate a deep understanding of the definition of agroecology and recognize its importance as a key research topic. Nevertheless, challenges remain regarding the adoption of agroecology in the current context. These challenges are mainly related to the orientation of national strategies that promote intensive practices, involving the overexploitation of water resources and excessive use of chemical fertilizers.

Among the major barriers, the researchers note a lack of understanding among policymakers about the benefits of agroecology. Current government programs often focus on intensive measures and emergency decisions, aimed at achieving defined goals quickly, which can be at odds with the long-term nature of the agroecological process.

- NGO representatives

The Torba "land" association was created in 2013 thanks to some notable initiatives, including the organization of a conference addressing various topics such as innovation, design, health, nutrition and organic food. In addition, an exhibition of local products was held at Dar Lahlou in Djanan Abdlatif (Mostaganem). These individual actions quickly led to the official creation of the association.

Torba's activities include waste sorting and recycling, covering a variety of materials such as plastic, cardboard, and household waste. The association also organises special outings for children, where they can discover vegetable gardens or visit "Djnan" (farms). In addition, visits to agroecological farms are offered to members, offering the opportunity to immerse themselves in peasant life and learn more about sustainable farming practices.

Participation in the collection of natural products, eco-construction with an emphasis on environmentally friendly construction methods, as well as the planting of plant species reflect the association's commitment to sustainability, environmental education and the promotion of nature-friendly lifestyles.

The Torba association, which currently has 250 members, offers a variety of activities, including permaculture training, free-range poultry farming, permaculture design courses, and the promotion of urban agriculture. These initiatives demonstrate the association's commitment to sustainable practices, environmental education and the promotion of nature-friendly lifestyles. In addition, it has trained 700 citizens in agroecology, strengthening its positive impact on the community and the environment.

Figure 12: The Torba association in Algeria proposes the Tafas initiative (AMAP), which is a short circuit aimed at bringing the consumer closer to the farmer. This approach facilitates the direct marketing of agricultural production, eliminating the need for intermediaries.

The second association is the APEB, Association for the Protection of the Environment and Heritage (APEB) in Beni Isguen (wilaya of Ghardaia), founded in 1989, began its journey by dedicating itself to the protection of the environment. Between its inception and the year 2000, it captured the public's attention with a vigorous initiative to thwart the establishment of a toxic waste sorting centre in its region. The publicized success of this operation has elevated APEB to the rank of a key player in the debates around environmental issues.

Subsequently, the association expanded its influence by organizing educational activities for schools, with the aim of raising students' awareness of the protection of the cultural and environmental heritage of oases.

It should be noted that the town of Ghardaia is home to an ecological village, Ksar Tafilelt. The creation of the new town of Tafilelt Tajdit dates back to 1997, representing a singular human experience from a social, urban and ecological point of view. It is the first ecological city in the Algerian desert, holistically integrating the rational management of the environment, climate change mitigation and adaptation, as well as the preservation of the oasis microclimate. The city was officially inaugurated in 2004.

Figure 13: View of Kser Tafililet (wilaya of Ghardaia), Algeria.

In 2014, the city was awarded the Arab League Environmental Prize. In November 2016, at the COP 22 in Marrakech, the city received the first prize for sustainable city. These recognitions highlight Tafilelt Tajdit's outstanding commitment and achievements in sustainability and environmental preservation.

- Representatives of the public authorities

Following interviews with officials from the Ministry of Agriculture and several institutions, including the National Institute of Agricultural Extension (INVA), the Technical Institute for Plant Protection (INPV), and the Technical Institute for Field Crops, it was confirmed that universities and institutions offer specific training programmes, including theoretical and practical courses on principles such as sustainable crop management, agroforestry, and the application of new technologies in sustainable agriculture, including biological control and biofertilizers. Scientific skills in agroecology are embodied by specialized researchers working in agricultural research centers, as well as by teacher-researchers within universities and national institutions. On the technical skills side, they are represented by agricultural extension workers who collaborate with farming communities to promote agro-ecological practices. These skills are distributed within various structures, highlighting the importance of educational and professional initiatives for the development of sustainable agriculture.

5.10. Overall Conclusion

Despite the implementation of various policies since independence, Algeria continues to experience difficulties in meeting its food needs due to insufficient agricultural production. Strategies and policies promote sustainable development and environmental protection, with an interest in agroecological practices.

However, the reality on the ground shows a gap between rhetoric and concrete actions. Current agricultural practices place greater emphasis on intensification, suggesting that this approach remains the only viable solution to achieving food security, especially in the face of an ever-growing population.

Thus, it is crucial to reassess and adjust current agricultural policies in order to reconcile food production objectives with the imperatives of sustainability and environmental preservation.

Chapter 6

National Report for Egypt

Gamal Siam (expert, UoC)

Chapter Six National Report for Egypt

6.1. Context Elements

6.1.1. The main indicators relating to agriculture

The agricultural sector is a major component in the Egyptian economy especially in the socioeconomic context. It produces about 40 percent of Egyptian population food needs, provides the livelihood for the rural population representing about 57 percent of the total population as mentioned above. The agricultural labour force is about 5.2 million workers accounting for almost 19.2% of the total employment and labour force. Agriculture contributes nearly 10.9 percent of the Gross Domestic Product (GDP) and about 6.7% of the national exports in 2021. The agricultural (fresh) and food exports altogether amount to USD 7.3 billion constituting about 16.7% of total exports in 2021. The total agricultural land in Egypt amounts to nearly 9.4 million feddans (3.9 million ha) and accounts for around 4 percent of the total area (MALR, 2022).

6.1.2. The state of natural resources

6.1.2.1. Land resources:

Egypt has a vast land area of more than 100 million ha but due to hot desert climate and extremely limited rainfall, only about 3.9% is suitable for agriculture and the remaining area (approximately 94%) is desert, with extreme aridity. As such, total agricultural (planted) land amounts to about 3.95 million ha (9.4 million fed), of which 65% (2.56 million ha or 6.1 million fed) represent the fertile '***Old lands'*** in the Nile valley and Delta; the remaining 1.39 million ha (3.3 million fed) represent ***'New lands*** located outside the Nile valley and Delta region. This cultivated area in the New lands is a result of long reclamation program implemented mainly by the GOE started in the Sixties aiming at expanding the national cultivated area to achieve two goals, first to increase food production in order to match the increasing food demand of population, second, to absorb more population to alleviate rural population intensity in the Old land. The arable land per person in Egypt is quite small (0.04 ha in 2020), however, this is offset to some extent by multiple cropping with two growing seasons (winter and summer) and intensive production making up a total cropped area of about 6.6 million ha (15.6 million fed).

6.1.2.2. Water resources:

Egypt is one of the most arid countries in the world. Water availability is a binding constraint for agricultural development in Egypt. Agriculture is almost entirely dependent on irrigation from the Nile's water resources that are more or less fixed at 55.5 bcm per year. Other fresh water sources include 2.5 billion m3 of desert ground water and 1.3 bcm of rains. This is in addition to desalinated water amounting to 0.38 bcm. As such, total fresh water is 59.68 bcm. Non-fresh water resources amount to 21.1 bcm including reuse of drainage and municipal water (13.51 bcm), and Delta shallow ground water (7.87 bcm). This makes up the total water resources to 81.06 bcm annually (2020). Agriculture is the largest user of water, accounting for 81.5 per cent of the total use. Two decades ago, Egypt's per capita water was about 1,000 m3 per year, which is equivalent to the global water poverty threshold. Since then, Egypt has entered an era of water poverty; with the population increasing

and the water resources almost fixed. Currently (2020) per capita water has decreased to about 597 cm per year.

6.1.2.3. Landholding fragmentation and dominance of smallholdings

Extreme landholding fragmentation is a key feature of Egyptian agriculture and is recognized as an impediment to agricultural development. Further, it is acknowledged that no policy has been instituted for protecting agricultural land against fragmentation. Fragmentation and the dominance of small-size farms both are increasing overtime with considerable portion of farms composed of two or several plots. According to the agricultural census (2009/2010) the total number of holdings at the sector level is 4.4 million, the agricultural area is 4.1 million ha and the average farm size is 0.92 ha. Farm sizes (holdings) less than 0.42 ha (or less than 1 fed) represent more than 48% of total holdings and farm sizes less than 1.26 ha account for more than 84% of total number of holdings. The small-scale family farming represents 24.23 million people working in the agriculture sector or 57% of the rural population. (Marzin, et al., 2017).

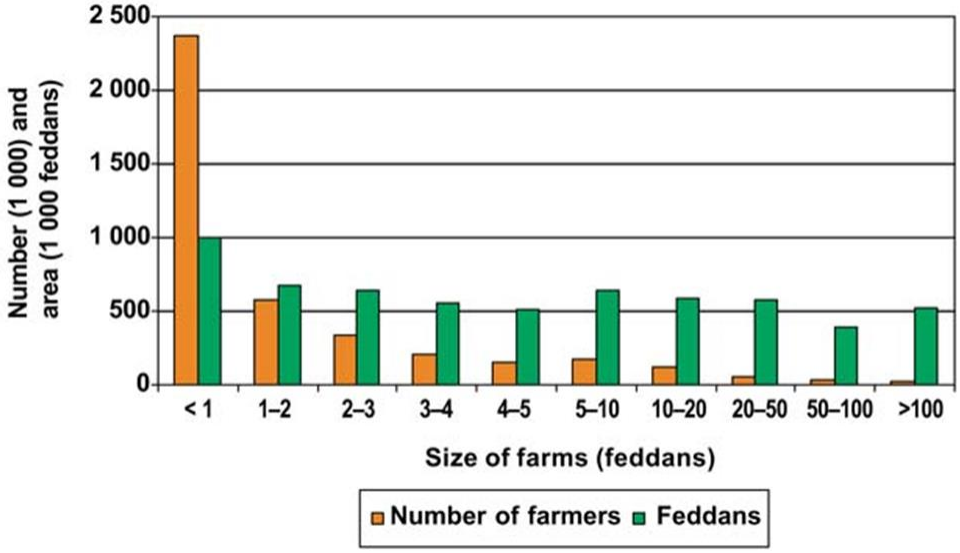


Figure 14: Distribution of holdings and cultivated area according to farm size classes in Egypt.

Due to high populatio intensity in the Old land compared to the New land, the average farm size in the first is smaller than in the second. In addition to the difference between the two zones in terms of farm size, there are other differences particularly concerning the structure of landholdings and the characteristics of holders. The maximum farm size in the Old land is limited to 50 fed (21 ha) imposed by the Agrarian Reform Law (ARL) inforced in the early Sixties and sence then , even though the Law was abolished later, farms became smaller and smaller under applied inheretage rules. In the New land, large farms up to 1000 fed (420 ha) can be found in the New land owned by companies and large local and Arab investors some of whom produce for agricultural exports and raw materials for agro-industries.

6.1.2.4. Deterioration of soil and water quality

The natural resource base in Egypt composed of land and water, is not only scarce quantity-wise, but also the quality of both resources are deteriorating. The land situation has increasingly deteriorated, especially due to the increase in the level of groundwater, the decrease in soil permeability of irrigation water, the increase in

soil salinity, the decrease in the soil's biological components, their degradation, and the slow response to agricultural inputs

6.1.3. The main agricultural production

Agricultural production in Egypt is composed mainly of crop and livestock productions. With respect to crop production, land is cultivated around the year with two main seasons; winter season (November-April) and summer season (May-September) as well as in-between season, Nili season. The main winter crops are wheat, "berseem" (Egyptian clover), sugar beet and broad beans. Among summer crops, maize, rice and cotton are dominant. Vegetable crops such as tomatoes, potatoes, cucumber, melons and others are cultivated around the agricultural year in the three seasons. Also, fruits are grown including mainly citrus, mango, grapes, banana, guava, and others. The agricultural land (3.95 million ha) is cultivated about 1.7 times a year making up the total cropped area about 6.7 million ha annually. About 49 per cent of the cropped area is used for cereals. The exportable crops, i.e., fruits and vegetables together constitute about 24.3 % of the total cropped area.In terms of livestock production, which contributes third of the agricultural GDP, the main activities include cattle,sheep, poultry, and fish. At the farm level, smallholder-based mixed farming is the dominant production system, (84% of farms cultivate less than 1.26 ha);.in which a variety of crops are grown combined with a few heads of cattle, sheep, and poultry.

6.1.4. Constraints and challenges

6.1.4.1. Climate change and threats

Egypt is one of the most vulnerable countries to the potential impacts and risks of climate change. It is virtually rainless and depends entirely (80%) on the river Nile (whose source is outside of Egypt) to meet its water needs. Precipitation minimally impacts on the economy; therefore, climate impacts on water supply are indirect and may result from impacts on the principal sources of the river Nile. Egyptian agriculture and food systems are vulnerable to potential climate change due to its dependence on irrigated crops. The climate is too dry to support crops and increasing water demands. The vast majority of crops are irrigated from Nile water creating great vulnerability to reductions in Nile flow. Climate change also increases crop evapotranspiration needs and can reduce yields creating vulnerability. Simultaneously, potential evapotranspiration from crops, an indicator of irrigation water demand, is expected to rise by up to 21% (Perez et al. 2021). Furthermore, agricultural lands in the Nile Delta face the threat of inundation from sea level rise (McCarl et al., 2015). Inundation along coastal areas would also lead to destruction of property and disruption of the proper functioning of infrastructure facilities directly exposed to the sea. There might be significant reduction in the agricultural production of Egypt since it is estimated that about 30-40% of Egypt's agricultural production is generated from the low-lying areas of the north Delta governorates that are susceptible to sea level rise (McCarl et al., 2015). In total, climate change would create substantial reduction in agricultural productivity. Egypt's Nile Delta and its coastal front on the Mediterranean are considered vulnerable to shoreline changes due to erosion and accretion, subsidence and sea level rise due to climate change.

The natural agricultural resources in Egypt are under constant threat due to climate change and increasing human pressures. As temperatures are expected to increase, and consequently, the increase in the gap

between available water resources and actual needs (FAO. 2021). Expectations have shown a significant decrease in wheat production in the period between 2012 and 2040 at a rate ranging from 11 to 12%, from 26 to 47% in rice, and from 40 to 47% in maize production (Mwenge Kahinda et al. 2021).

6.1.4.2. Anthropogenic pressure and degradation of natural resources (land, water and biodiversity

Egypt faces a considerable challenge over the next three decades with a population projected to increase, at 1.8% annual growth rate, from 104 million currently (2022) to 120 million by 2030 and to 171 million people by 2050. Given the limited water supply, and the growing population leading to increasing water demand for related industrial and other non-agricultural uses; agriculture will inevitably face water availability reduction. Growing water scarcity will increasingly constrain agricultural and food production growth and will likely shrink Egyptian farmers' abilities to produce grains. Meanwhile, growing demand for high-value foods will put further pressure on the natural resource base. Agricultural production in Egypt has not kept pace with population growth. It meets only 40 percent of national food needs while the remaining 60 percent is imported from the international market. Such a food gap i.e., 60 percent, is widening over time given the growing population and the increasingly limited land and water resources. In the long run, factors other than population growth, will augment the reverse impact of population increase on irrigation water availability and consequently on agricultural and food production in Egypt. These factors include, among others, climate change, and the Grand Ethiopian Renaissance Dam (GERD), which has already stored 41 bcm of Nile water, as well as the current high crop intensification practiced in Egypt' agriculture.

6.1.4.3. Agro-climatic and technical constraints

Based on soil characteristics and water resources, the agricultural land can be classified to four agro-ecological zones; Old Land, New Land, Oases, and Rainfed areas. The Old Land zone, as has been mentioned, is located in the Nile Valley and Delta Regions covering a total area of 2.5 million ha (representing 65% of the total cultivated land) and is characterized by alluvial soils (clay to loamy), deep, flat and fertile. However, traditional soil fertility management can lead to the mining of nutrients from the soil due to an insufficient application of nutrients, to nutrient imbalances and to environmental contamination through the over-application of fertilizers. The Nile is the main source of water for irrigation. The New land zone is located mainly on both the east and west sides of the Delta and scattered over various areas in the country. The New lands covering an area of 1.3 million ha (35% of the total cultivated land) , lie mostly in the desert outside the old valley and Delata areas and have been reclaimed to be cultivated. New lands are initially not fertile. However, over time, with good soil and water management techniques (especially the incorporation of compost and crop residues), their productivity improves and, in successful areas, eventually approaches that in the old lands. Reclamation of this land started in the early 1950s and is continuing. Nile water is the main source of irrigation water but in some desert areas underground water is the only source of irrigation water. Sprinkler and drip irrigation regimes are practiced. The Oases zone is characterized by alluvial, sandy and calcareous soils. They cover a total area of 40 000 ha. Underground water is the main source for irrigation. The Rain fed areas zone includes about 0.17 million ha of land located in the north coastal areas, where rainfall fluctuates between 100 and 200 mm annually.

6.1.4.4. Food dependence and state of coverage of Nutrition needs by national production

In average, Egypt imports about 60% of its food needs with varying degrees as to basic food commodities. All basic food commodities are imported with high dependency on international markets; yet with varying import dependency ratios. Generally, consumption exceeds production for all commodities except fruits and vegetables, implying that Egypt is fully self-sufficient only in fruits and vegetables. The demand for food commodities is increasing in Egypt due to the increase in the population and improvements in living standards.

The most important food commodities in the Egyptian traditional diet are wheat, maize, edible oils, sugar, and broad beans. These commodities are heavily imported to bridge the gap between consumption and production. Self-sufficiency ratios for these commodities are 42%, 45%, 10%, 80% and 17% respectively in 2020. Egypt had a deficit in milk, meat, and fish. Self-sufficiency ratios for red meat, poultry meat, milk and milk, and fish products are 55%, 94%,83%, 82% respectively (MALR, 2020, a). Horticultural crops are all, with few exceptions, exportable crops, and almost the entire agricultural export is made up of horticultural crops. They are mainly citrus, potatoes, onion, table grapes, tomatoes, green beans, strawberry, artichoke, green pepper and mangoes. Total exports of fruits and vegetables together amounted to more than 3.8 MMT annually, of which 2.2 MMT of fruits and 1.6 MMT of vegetables in 2020.

Poverty has driven an increase in household food insecurity. Estimates of CAPMAS from the 2010–2011 Household Income, Expenditure, and Consumption Survey (Egypt, CAPMAS 2011) show that income poverty increased from 19.6% in 2004–2005, to 21.6% in 2008–2009, to 25.2% (21 million people) in 2010–2011and to 27% (24 million people) in 2015. Between 2009 and 2011, 15.2 percent of the population (12.2 million people) fell into poverty, double the percentage of those who moved out of poverty (7.7%), and a further 12.6% of the population remained in chronic poverty.

Over the past decade, the poverty rate in Egypt has steadily increased. As of mid-2016, the poverty rate in Egypt was 27.8 percent; an increase of 2.6% from 2010.This high poverty rate in Egypt has affected children, many of whom are malnourished. In mid-2014, 31 percent of children under the age of 5 were considered to have stunted growth because of malnutrition. Often, families who have little money opt to spend it on cheaper food options rather than nutritious food. Poverty in Egypt affects not only many children, but also populations living in rural areas. When compared to urban areas in Egypt, the poverty rate in rural areas was 37% higher as of July 2016. In 2019, 32.5 percent of the population was living below the national poverty line, up from 27.8% in 2015.Extreme poverty rate is estimated at 6.2% (CAPMAS). Rising poverty has resulted in increasing dependence on cheaper, calorie dense food, including subsidized commodities, all of which have a correlation with obesity. Compounded by high food prices, changing lifestyles, and poor nutritional awareness, obesity in Egypt is on the rise, with an estimated 48% of women older than 15 being obese. The coexistence of obesity and stunting has added to the phenomenon of the double burden of malnutrition in Egypt, now among the highest in the world

6.1.4.5. The crisis in world markets

Egypt is a net food-importing country, and rely on world markets in meeting, in average, 60% of the population food needs with varying ratios at the individual commodity level as mentioned before. The total food bill is about

USD 12.9 billion I 2021 (CAPMAS,2021) representing 14.5% of the national imports. Egypt is the largest importer of wheat in the world with12 million tons annually representing 58% of its wheat demand, and is a large importer of corn, about 8 million tons annually, to be used as feed in poultry production. This situation makes the country vulnerable to fluctuations in international food prices. Higher global food and fuel prices and lower foreign currency inflows from exports, tourism, foreign direct investment, and other sources that have only partly been offset by increased remittances from abroad, have resulted in a widening of the balance-of-payments deficit. The challenging macro-economic backdrop has adversely affected households. The country, therefore, is exposed to risks and price fluctuations in world food markets caused by factors such as food crises; like that of 2008, disturbance in supply chains, like the case connected with Covid-19 pandemic, wars, and climate change.

6.1.4.6. The challenges and issues of the future

As has been demonstrated through the previous sections, there will be three main challenges facing Egypt in the future; population growth, GERD and other planned Ethiopian Dams, and climate change, as well as external shocks. Under the business-as-usual scenario, with no serious interventions, the overall effect of these challenges will lead to severe deterioration in the national food security. With the Nile supplying 97% of Egypt's renewable water, losing increasing quantities of the water supply because of these factors, could cause additional challenges to Egypt's water security. A further decrease in water supply would lead to a decline in arable land available for agriculture, and with agriculture being the biggest employer of labour force in Egypt, water scarcity could lead to increased unemployment levels and could endanger the country's social stability. It is imperative on the GOE and the entire population to act swiftly and decisively to mitigate water scarcity, implement water conservation techniques, control water pollution, develop plans that would install more efficient irrigation techniques, and control water pollution in order to avoid a disaster (Dakkak, 2016). Moreover, problems of fragmentation and dominance of smallholders are projected to worsen taking into consideration the limited land coupled with increasing agricultural population and continuing heritage system.

The ecosystems, on which Egyptian farmers rely, are increasingly undermined. Access to suitable agricultural land is declining, and soil and water resources are increasingly restricted and degraded. The majority of farmers cultivate on small plots of land where water is becoming increasingly scarce, threatening their vital source of income and nutrition. In addition, the cultivated area in the Old Land is threatened by increasing cases of aggression, even though prohibited by law, by rural residents transforming agricultural land to housing and other non-agricultural uses. Egyptian agriculture, as mentioned above, is also vulnerable to potential climate change due to its dependence on irrigated crops, a climate that is too dry to support crops, and increasing water demands (Mc.Carl et al. 2015).

In the context of the GOE efforts to increase food production, it has recently launched four mega projects for reclamation of an area of about 1.5 million ha in the desert, or about 38% of the current cultivated area, which will add to the existing pressures on water resources. More than three quarters of this area is planned to be irrigated by triple-treated drainage water taken from the flood irrigation system in the Delta Region. In the long-run, these projects would, most probably, lead to adverse environmental impacts particularly as to soil and water quality and biodiversity.

6.2. The Strategies Adopted

In the context of Egypt's efforts in the field of agricultural production and preservation of natural resources (land, water and biodiversity), five strategies are adopted. These are the Sustainable Agricultural Development Strategy (SDS) 2030, the Strategy for Managing Water Scarcity – National Water Resources Plan (NWRP 2017-2037), the National Climate Change Strategy (NCCS) 2050, Egyptian Biodiversity Strategy and Action Plan (EBSAP) (2015-2030), and the National Action Plan to Combat Desertification (NAPCD). There are no strategies adopted at the Governorate level. However, each of the 27 governorates takes part of the implementation of the national strategies proportionally with its weight in population and environmental resources.

6.2.1. Definition of the Sustainable Agricultural Development Strategy (SADS) (2020-2030)

The Sustainable Agricultural Development Strategy (SDS) 2030 has been designed as a sector strategy in light of the main features of Egypt's Sustainable Development Strategy (SDS) 2030 of which the Vision is as follows: "By 2030, the new Egypt will achieve a competitive, balanced, diversified and knowledge-based economy, characterized by justice, social integration and participation, with a balanced and diversified ecosystem, benefiting from its strategic location and human capital to achieve sustainable development for a better life to all Egyptians". This national-level strategy was developed, in 2016, through extensive consultations with stakeholders, the international development community, the private sector, and civil society actors.

The main orientation of SADS 2030 is the achievement of substantial increase in food production from both productivities increase and more reclaimed and cultivated land based largely on the agricultural intensification approach. In fact, the SADS is a continuation of the historical development of the agricultural strategies in Egypt for decades, but with more emphasis on facing the challenges of increasing water scarcity and impacts of climate change.

SADS Vision: "Inclusive economic and social development based on fast, sustainable and inclusive growth of agricultural sector within the framework of integrated rural development to help, in particular, marginalized groups and alleviate rural poverty".

Mission Statement: "Modernize the agricultural sector to achieve food security for all citizens and improve nutrition and standards of living of rural population, through improving the efficiency of resources use and capitalizing on the geographic comparative advantages of different agricultural regions".

The SADS and related agricultural policies have revolved around one main objective of providing adequate basic foods for the population, with promoting agricultural exports as secondary objective. Egypt's resource and population parameters interact with policy choices and political decisions in shaping its agriculture: arable land and water remain severely limited while the population is growing at relatively high rates. Government, pursuing its objective to provide adequate food to its people affected by persistent inflation in food prices and prevailing high poverty rates, intervenes in the agricultural sector with costly support mechanisms, such as food subsidies and government procurement at higher than market prices particularly in the case of wheat until 2016.

The action plan of the Updated Sustainable Agricultural Strategy 2030 is based on the vision, the mission statement and the strategic objectives presented in the strategy document. The strategic objectives are to:

i. Achieve food security and improved nutrition (to address undernourishment, food insecurity, achieve sustainable agriculture productivity growth, sustainable agriculture growth), focusing on decreasing the imports of agriculture products.

ii. Enhance sustainable agriculture (focus: sustainable management of natural resources).

iii. Eradicate poverty in rural areas, improve income and standards of living (focus: Upper Egypt).

iv. Adapt to climate change and mitigate its impacts.

v. Increase the competitiveness of agricultural products in local and international markets (functioning and inclusive value chains - increase exports).

vi. Create job opportunities for employment, especially for youth and women

vii. Provide absolute priority to the management of the limited and scarce water resources and their rational use in agriculture.

6.2.2. Strategy for Managing Water Scarcity – National Water Resources Plan (NWRP 2017-2037)

The overall objective of NWRP is to mitigate Egypt's water scarcity problem covering 20 years period from 2017-2037, dealing with four pillars; water quality, water conservation, water resources development, and raising awareness for rational water consumption. It involves nine ministries and various international partners. The eventual investments in the NWRP is planned to be EGP 900 billion. The Ministry of Water Resources and Irrigation contribute EGP 240 billion (27%) to the NWRP. The government will also be allocating EGP 70 billion of the initiative towards solving Egypt's water shortage crisis (MWRI. 2005).

6.2.3. National Climate Change Strategy (NCCS) 2050

Objectives and Priorities: Egypt's National Climate Change strategy is designed to consolidate all aspects of climate change in one document to be a basic reference that ensures the integration of climate change dimension into general planning of all sectors in the country. It was developed at the request of the National Council for Climate Change. The strategy contains five key goals and sets directions to achieve each objective:

- ✓ **Goal 1:** Achieving Sustainable Economic Growth and Low-Emission Development in Various Sectors
- ✓ **Goal 2:** Enhancing Adaptive Capacity and Resilience to Climate Change and Alleviating the Associated Negative Impacts
- ✓ **Goal 3:** Enhancing Climate Change Action Governance
- ✓ **Goal 4:** Enhancing Climate Financing Infrastructure
- ✓ **Goal 5:** Enhancing Scientific Research, Technology Transfer, Knowledge Management and Awareness to Combat Climate Change

(https://climate-laws.org/documents/egypt-national-climate-change-strategy-nccs2050_8bfc?id=egypt-national-climate-change-strategy-nccs-2050_d3b1)

6.2.4. Egyptian Biodiversity Strategy and Action Plan (EBSAP) (2015-2030)

The EBSAP was produced through UNDP, GEF, and PIMS in 2016, it is a science work conducted by national team of biodiversity specialists. It establishes a Strategic Framework to guide the fulfilment of the mission of the EBSAP to 2030. It outlines 5 policy areas where action is necessary: conserving and restoring nature; addressing the drivers of biodiversity loss; using biodiversity sustainably; mainstreaming and awareness-raising; and enhancing implementation and cooperation (Report Appendix in section 6.6.2). Under each policy area, targets to be achieved by 2030 have been defined. These address protected areas, ecosystem restoration, genetic diversity, invasive alien species, climate change, pollution, sustainable agriculture and fisheries, biotechnology, mainstreaming of biodiversity in the public and private sectors, and education and public awareness, amongst others. Nested within 22 targets are 78 actions, the implementation of which contributes to the achievement of each target. These targets and actions are aligned with biodiversity targets at global and EU level, while reflecting national priorities and capacities.

Objectives and Priorities: NBSAP Vision is “By 2030 biodiversity in Egypt is valued, mainstreamed, maintained for the good livelihoods and conserved for the sustainable use of future generations”.

The NBSAP Mission is “Egypt takes effective and innovative actions to reduce the loss of biodiversity to ensure that by 2030 ecosystems continue to provide their services to all Egyptian and also ensure pressures on biodiversity are reduced; biological resources are sustainably used and benefits arising out of utilization of genetic resources are shared in a fair and equitable manner; biodiversity issues and values mainstreamed and appropriate policies are effectively implemented in a participatory approach.”

Priority actions: It is planned to give priorities on the following Strategic Goals and Targets:

- Strategic Goal 1: Conserve and manage terrestrial and aquatic biodiversity to ensure sustainable use and equitable benefits to the people
- Strategic Goal 2: Sustainable use of natural resources:
- Strategic Goal 3: Access to genetic resources and Benefit sharing (Nagoya protocol, indigenous knowledge and traditions)
- Strategic Goal 4: Improve our understanding of biological diversity and ecosystem functioning in a changing environment:
- Strategic Goal 5: Prepare for climate change and combat desertification:
- Strategic Goal 6: Build partnerships and integrate biodiversity into all national development frameworks.

6.2.5. National Action Plan to Combat Desertification (NAPCD)

Objectives and Priorities: Advanced priority is given to protect the ecosystems in each zone from land deterioration due to salinity water logging and seawater intrusion in the fertile soils of the Nile Delta region

- Development of the proper utilization and management policy of water resources through updating of the previous studies, establishing of data bases, optimizing use of water resources, time and schedule of irrigation, reuse of drainage and waste water and providing alternatives for maximizing the economic return per water unit. Use of modern technologies for determining the main characteristics of each groundwater aquifer, its maximum capacity and safe yield.
- Maximization of the role of women in different activities of socio-economic development, in particular, those concerned with combating desertification

6.3. Analysis of the Strategies Adopted and the Place of Agroecology

6.3.1. The dynamics of agricultural growth of the main branches of production, discussing the extension of productive capacities, and the means mobilized to achieve them.

The agricultural production in Egypt consists of two main branches; the crop production and livestock production. The crop production is composed of two main groups of crops; the first group is the field crops including cereal crops, pulses, oilseed crops, fodder crops, and fibre crops, the second group is the horticultural crops including fruits, vegetables, and medicinal and aromatic crops. The livestock production consists of three main branches; animal production (cows, buffaloes, sheep, goats, and draft animals), poultry production, and fish production. Considering the ecological zones, the composition of the agricultural production in the Old Land is different from that in the New Land; where the first is dominated by traditional production of field crops and livestock activities with little horticultural activities, and the second is dominated by high-value crops of fruits and vegetable with little portion of field crops and livestock activities.

In aggregate, agricultural production grew at 3% annually throughout the last three decades (SADS,2020) with varying rates regarding the major components. Annual production of fruits, vegetables, and roots and tubers (mainly potatoes) for export grew at 3.5, 2.1 and 4.3%, respectively, whereas meat production grew at an annual rate of 3.8% from 1990 to 2020 and cereals at 1.9% (Perez et al 2021). The agricultural exports, recently amounted to 6.5 million tons (2023) valued at USD 3.3 billion, composed mainly of fruits and vegetables generated in the New Land production.

With respect to mobilization of water resources, only around 10% of the land is irrigated with groundwater either from renewable or non-renewable sources (FAO 2011). Egypt's old lands, around the Nile Valley and Delta, constitute around 65% of the country's cultivated areas and rely on the Nile as their source of water. However, farmers in the Nile Valley and Delta are increasingly relying on groundwater from the renewable Nile aquifer to cope with water shortages in irrigation canals, with the groundwater pumping rate estimated at three bcm per year, excluding other aquifers (ICARDA 2011; El-Didi and Corbera 2017). Significant part of the New Lands relies on groundwater for irrigation (McCarl et al. 2015) where the non-renewable Nubian Sandstone Aquifer is becoming increasingly depleted as well (Viscomi 2010; MWRI 2014).

6.3.2. The place given to agroecology in the Sustainable Agricultural Development Strategy (SADS)

Agroecology is not mentioned explicitly in the SADS; thus, it has not been defined. Further, Egypt has no history of “agroecology” in its present-day form. It is not legally defined and thus there is no legal framework to regulate it. However, it is not illegal for producers to sell their products direct to consumers who are willing to share risks with the farmers and buy their produce. The SADS objectives are designed in such a way to be aligned, to a large extent, with the UN SDGs. The SADS approached agroecology through four angles; preservation of water, conservation of soil, crop-livestock integration, recycling of farm waste.

The Action Plan of SADS gave an absolute priority to the sustainable use of irrigation water through improving the management systems of water and irrigation networks and upscaling the use of modern irrigation technologies. The Action Plan is targeting the increase of the proportion of lands irrigated with modernized irrigation methods (modernized surface, sprinkler, drip) to around 31.7% by 2030, in addition to increasing the efficiency of field irrigation for 0.92 million ha (2.2 million feddan) in the New Valley and Delta regions from 50% (currently) to 100% in 2030. Moreover, contributing to the saving of additional 0.6 billion cubic meters of irrigation water as a result of rehabilitating and improving the management field irrigation in reclaimed lands.

Historically, the main challenge that has been facing the Egyptian agriculture particularly throughout the last three decades.is to produce more food in order to first, meet the increasing food demand due to increasing population, second to accelerate agricultural exports needed for foreign exchange. It should be noted, however, that the food security objective has been given increasingly a higher priority over exports in the context of the strategies of agriculture adopted since the Eighties. Under the implementation of the Economic Reform and Structural Adjustment Program (ERSAP) and the liberalization of the agricultural sector starting in the late Eighties, cotton exports have been gradually waived in favour of cereal production. Also, in the same direction rice exports has been banned by GOE and area of rice, being water intensive crop, has been limited to almost half of the regular area, starting 2016 due to increasing water scarcity. In addition, the previous strategies adopted the agricultural intensification techniques in both the old land and new land based mainly on chemical fertilizers and pesticides and irrigation. Further, as mentioned earlier, GOE launched lately several mega reclamation projects to add about 1.5 million ha (MALR, SADS) to the cultivated land in Egypt.

6.3.3. Weak signals evoking or promoting agroecology in Egypt

Although the five strategies adopted did not mention the term “agroecology” explicitly, but in reality, there are many signals that promote agroecology through agroecology-related practices and activities, and not necessarily as a holistic integrated agroecological farming approach. These practices and activities are adopted by farmers and other agroecology-related actors or even by adjusting some policies toward agroecological sustainability in case its benefits are perceived and proven. Following are some examples:

Organic agriculture in Egypt

- Organic agriculture in Egypt occupies 116000 ha representing about 2.9% of the total cultivated land in 2021. The number of organic farms grew to approximately 970 farms covering the reported area and almost half of the farms were located in the Middle Egypt

governorates, concentrated in the Governorate of Fayoum, 100 Km south of Cairo.

- More than half of the organic farms in Egypt are 4.5 to 20 hectares in size. There are only a few farm enterprises larger than 420 ha, accounting for 20% of total organic farmland, and are located in the new reclaimed desert land.
- The range of certified organic products currently produced include vegetables, (31%) medicinal an aromatic plant (27%), field crops (18%), fruits (15%), fodder (5%), oil crops (4%), fiber crops, and sugar.
- Most certified organic production in Egypt is geared towards export markets, and up to half of Egypt's organic produce (40-50%) is exported to EU and USA. The remainder (50-60%) is sold to high income consumers at the domestic market. Further, the organic products find increasing share in the local market as well as exports to the EU and other markets.
- There are some institutions that are related to organic agriculture including the Centre for Organic Agriculture (COA) affiliated to the MALR and the Egyptian Biodynamic Association (EBDA) which is an independent non-governmental organization that supports farmers in Egypt to shift from conventional practices to sustainable, organic, and biodynamic agriculture. (https://directory.ifoam.bio/affiliates/762-egyptian-biodynamic-association) (see more details in Abdel-Hakim and Siam, 2019).
- A national legislation for organic agriculture has been issued in 2020.
- There is a national certification system for organic production. There are two levels of organic farming in Egypt, certified organic production and non- certified or agro-ecological farming. Certified production is mostly geared to products destined for exports. Organic certification in Egypt is mainly provided by two local organizations: the Egyptian Center for Organic Agriculture (ECOA) and the Center of Organic Agriculture in Egypt (COAE). Both companies are members of IFOAM and accredited according to ISO 65 by a European accreditation body to certify for EUREPGAP. Neither is accredited according to NOP-USDA and JAS yet, but they cooperate with the accredited bodies to certify their customers upon request according to NOP and JAS.In addition to the two local organizations, there is a number of foreign certification bodies (Certifiers) working in Egypt. This number changes overtime due to exit and entry movement with regard to inspection and certification activities. Almost a decade ago, there were seven foreign certifiers; these are the Soil Association (UK), IMO (Switzerland), IMC (Italy), and from Germany,BSC, Lacon and QC & I. Recently, while QC&I has withdrawn, other two new certifiers have entered; CERES from Germany and a-CERT from Greece (Abdel-Hakim and Siam,2019).https://hal.science/hal-02137639/document.
- ***Production of organic Medicinal and Aromatic Plants (MAPs):*** In addition to the certified organic farms mentioned above, Egypt produces organic Medicinal and Aromatic Plants (MAPs). These crops are mainly grown in Upper Egypt's provinces of Minya, Beni Suef, Assiut and Fayoum. Some 630 ha are cultivated with MAPs in Fayoum, while the whole country grows these crops in 42,000 ha. (http://www.xinhuanet.com//english/2017-07/29/c_136482723.htm).

Other signals

(i) some donors are leading efforts in the field of ***sustainable agriculture and agroecological practices***. In this regard, the USAID is financing and supporting projects for organizing horticulture small producers under Farmers Organizations (FOs) to adopt Good Agricultural Practices (GAP) in production and market the produce through a collective action. There are also activities to support farmers' incomes such as recycling and food processing. These projects are implemented in Upper Egypt where poverty rates are so high (https://pdf.usaid.gov/pdf_docs/PA00T5RT.pdf).

(ii) ***Planned reform of fertilizer subsidy policy***: Policy makers, as will be reported in the perception interview, perceive the reality that providing the farmers by subsidized nitrogenous fertilizer encourage them to overdose application. It thus planned to shift from in-kind subsidy to cash subsidy system which would lead to reduction in fertilizer use.

(iii) There is an increasing tendency of farmers to establish ***NGOs as an alternative to cooperative*** to avoid legislative and bureaucratic difficulties caused by the outdated Law of Cooperative (1976).

(iv) The GOE has recently issued a law for ***controlling overdrawing of the deep groundwater*** in the New Land.

(v) There is an increasing use of ***clean and renewable energy***, particularly solar energy.

Programs and projects to be implemented in some fields related to agroecology

As mentioned above, agroecology is not mentioned explicitly in the SADS, neither as a title of a project nor as a title for a component or activity. However, the SADS includes a number of policies, programs and projects that have some objectives and/or activities related to the basic principles of agroecology. Notice that SADS is essentially designed to be largely consistent with the UN SDGs. Therefore, although the strategy did not explicitly mention agroecology, many of its policies and programs are, directly or indirectly, aligned with or at least do not contradict with, the principles of agroecology, in particular efficiency, recycling, diversity, flexibility, and synergy. Also, some indicators in terms of human and social values and the circular and solidarity economy can be found.

In SADS projects there are many indicators that could be related to the principles of agroecology in one way or another. Principles of recycling, efficiency, and economic diversification have been found to be served and linked most to the majority of projects and related indicators. Therefore, these projects can be seen as leverages to agroecology in Egypt. On the other hand, other principles have been either neglected or dealt with partially such as "culture and food traditions", "responsible governance" and Circular and solidarity economy".

In Table 1 in the Report Appendix section 6.6.2 national programs and projects included in the SADS, are listed as well as their objectives and performance indicators. The following are selected projects in the fields of rationalization of water use, recycling and climate change adaptation: Some objectives of these projects are related to principles of agroecology, they are highlighted in bold-italic, whereas the other objectives

1) The National Project for the development of on-farm irrigation and rationalization of irrigation water use in agriculture

- Increase the cultivated area in the Nile Valley and Delta regions by around 160-200 thousand feddan, which is currently used in ditches, Marwas and Masqas (ditches).

- ***Improve land fertility and contribute to increase its productivity by 20-30%.***
- Improve the irrigation system in the old and new lands to the improved and modernized irrigation system.
- ***Achieve equity in the distribution of irrigation water among farmers.***
- Increase the productivity of land unit from 15 to 20% in the developed areas.
- ***Raise the average income of small farmers by 15-20%.***
- Add financial capital (capitalization) to the agriculture land value as a result of the improvements.
- ***Maintain and improve farmers' health by reducing the impacts of endemic diseases.***
- Contribute to the improvement and modernization of irrigation management (estimation of irrigation water requirements) at the national level.
- ***Provide energy needed for irrigation.***
- Double agricultural mechanization rates and increase crop intensification rates from around 177% to 195% by 2030.
- Increase investment opportunities for manufacturing equipment and advanced on- farm irrigation raw materials, and increase farmers' income.
- Create enabling environment to stimulate commercial business and investment market in Egypt.

2) The National Project for the development of ***drought-tolerant fruit crops***

- Expand the cultivation of high-quality varieties of date palms, olives, pomegranates, figs and cactus pears, and increase their productivity:
- ***Increase the number of date palm trees by about 5 million trees.***
- ***Increase the productivity of olive from 3.3 to 4.5 ton per feddan for table varieties, and from 5 to 6.5 ton per feddan for oil varieties.***
- Increase pomegranate productivity from 8.4 to 11 ton per feddan.
- Increase fig area (of improved varieties) by 3,000 feddan.
- Increase cactus pear area (of improved varieties) by 1,000 feddan

3) The National Project for the integral development of rainfed areas

- Double the amounts of stored waters from rainwater harvesting needed for drinking water for human, animal and supplementary irrigation for some vegetable crops.
- Add new agricultural lands and increase the productivity of field and horticulture crops in the valleys.
- ***Develop and manage the range lands, improve grazing practices, and prevent overgrazing.***
- Improve the productivity of sheep, goats and camels and enhance the veterinary services.
- ***Increase farmers' income and provide new job opportunities for the youth.***
- ***Enhance the capacity and the skills of Bedouin women***

4) The National Program to support agriculture research, technology transfer and agricultural extension

i. The National Project to develop agricultural research system and technology transfer

- ***Coordination and integration between the agriculture research institutions in the implementation of the research national plan to address existing and future challenges facing the agricultural sector.***

- The use of latest scientific achievements in developing the research programs to achieve horizontal and vertical expansion in local production of strategic food crops and maximize the benefits of land and water units.
- ***Update research programs to develop high-yielding new crop varieties, adaptable to extreme weather conditions, and resistant to diseases and pests.***
- Develop, update, and maintain the infrastructure of the agriculture scientific research institutions.
- Human capacity development of research staff, especially young researchers and assistant staff, and explore them to international expertise.
- Sustainable connection between the agriculture scientific research system, the agricultural extension services and technology transfer, and the industrial institutions.
- ***Strengthen the cooperation with regional and international research institutions, and ensure the continuity of such cooperation.***
- Adapt modern and emerging technologies to the local conditions to benefit the agricultural sector.
- ***Ensure enabling environment conducive to scientific research and innovation.***
- Produce high- quality and high-yielding new varieties of strategic crops based on applied scientific research to achieve sustainable agriculture development.
- ***Reduce the gap between production and consumption, and achieve food security in strategic crops.***

ii. The National Project to develop the performance of extension centres (as an entry point to develop the agricultural extension performance in Egypt)

iii. The National Project for developing the capacity of agricultural extensionists to cope with technology advancement in agriculture development

iv. The National Project for the ***application of information technology and communication to enhance the performance of extension services system***

- ***Effective extension system with clear vision, mission, and specific objectives agreed upon among all stakeholders of the agricultural extension system.***
- Upgraded and equipped extension centres capable of providing demand-driven extension services to agricultural producers in line with the strategic objectives of Egypt's agriculture development.
- Qualified extension cadres capable of convincing producers to adopt the scientific recommendations and good agriculture practices in farming that meet the environmental and export requirements.
- Strong linkages with the agriculture scientific research institutions to develop realistic recommendations to meet the needs of small farmers and large producers.
- Achieve effective field presence of the agricultural extension systems and its services at the village level through trained rural extension agents, who are familiar with the country's development objectives.

The means mobilized for the implementation:

The table below presents the budgets allocated to the projects of the SADS as well as the source of funding being public or private.

Table 19: Amount and source of funding of programs and projects of Egypt's SADS.

Program / Project	Amount and Source of Funding (million)		
	Public sector	**Private sector**	**Total EGP**
Productive Programs and Projects			
1. The National Program for the Sustainable Use of Agriculture Resources.	11974.2	30104.1	42078.3
2. The National Program for the development of field crops. 3	455	428	883
3. The National Program for the development of horticulture crops.	118.6	6665.6	6784.2
4. The National Program for the development of livestock, poultry and fish production.	1447	10145	11592
5. The National program for the modernization and development of marketing and processing, promotion of investments and competitiveness.	153.3	835.9	989.2
Total	**14148.1**	**48178.6**	**62326.7**
Enabling and Complementary Programs and Projects			
6. The National Program for territorial development, and economic and social recovery.	2250.5	0	2250.5
7. The National Program for the upgrading and development of information technology, communication and digital transformation.	215	0	215
8. The National Project for institutional reforms.	492	108	600
9. The National Project for agriculture policy reforms	30	5	35
10. The National Project to support agricultural research, technology transfer and agricultural extension	2452	1815	4267
Total	**5439.8**	**1928**	**7367.5**
Grand total	**19587.6**	**50106.6**	**69694.2**
Contribution (%)	**28.11**	**71.89**	**100**

Orientations and/or policies with regard to the development of agroecology (leverages and contradictions):

In the below Table, we compile the national indicators of the SADS projects that could be related to the principles of agroecology in one way or another. It is clear that principles of recycling, efficiency, and economic diversification have been found to be served and linked most to the majority of projects and related indicators. Therefore, these projects can be seen as leverages to agroecology in Egypt. On the other hand, other principles

have been either neglected or dealt with partially such as “culture and food traditions”, “responsible governance” and Circular and solidarity economy”.

Table 20: The relationship between the agroecology principles and the national indicators targeted by the SADS’ projects in 2030.

Agroecology principles	National indicator	Unit	Current Status	Notes	Target 2030
Resilience	Percentage of subsidy granted to the agricultural sector out of total government subsidy	%	2.40%	(2016-2017)	5%
	Total investments in the agricultural sector	(billion EGP)	21.9	(2016-2017)	40
	Subsidy granted to the agriculture sector out of the total subsidies	%	2.40%	(2016-2017)	5%
Synergies	GHG emission rate from agriculture sector	%	1.20%	--	1%
Synergies, Efficiency	The ratio of the use of organic fertilizers	%	16%	(2016-2017)	25%
Efficiency	Total Factor Productivity	%	1.30%	(2011-2016)	2.56%
	Agricultural value-added growth rate	%	3.70%	(2019-2020)	4.50%
	Agriculture contributes to the GDP	%	12%	(2019-2020)	15%
	The ratio of cultivated lands with organic crops to the total cultivated lands	%	3%	(2016-2017)	6.46%
	The ratio of reclaimed lands adopting sustainable agriculture methods to the total formally and recently reclaimed lands	%	35%	(2016-2017)	71%
	The ratio of the use of fertilizers and chemical pesticides to the total fetilizers used in the agriculture sector	%	84%	(2016-2017)	75%
Recycling, efficiency	Public expenditure on the agriculture sector as a percentage of the GDP	%	0.37%	(2016-2017)	0.45%
Recycling	The ratio of lands irrigated using the advanced and modern irrigation methods	%	16.50%	(2016-2017)	31.70%
	The ratio of solar energy used in the agriculture sector to the total energy used	%	1.50%	(2016-2017)	10%
	The rainwater harvesting capacity	(Million m3)	3.2	--	8.1
Recycling, Synergies	Agricultural waste recycling and its conversion to compost and other uses	%	10%	(2016-2017)	30%
Economic diversification	Ratio of loans and financial instruments offered to small farmers (small and medium holders) to the total expenditure on agriculture sector	%	53%	(2016-2017)	55%
	percentage of loans and financial instruments offered to small farmers to total expenditure on agricultural sector	%	53%	(2016-2017)	55%

Co-create and sharing knowledge	Number of agricultural extensionists	per 1000 farmers	0.7	With the application of e-extension	2
	Expenditure on research and development in the agriculture sector	%	0.07%	(2016-2017)	1%
Human and social values	Rural unemployment (unemployment rate for 15-24 age bracket for 2017)	(especially for the youth)	30%	(2019)	15%
	The ratio of the rural population with access to drinking water	%	96.70%	(2016-2017)	100%
	The ratio of the rural population with access to sanitation services	%	37%	(2016-2017)	50%
Diversity	The ratio of lost agricultural lands annually due to encroachments, deterioration and desertification	%	0.40%	(2016-2017)	0.01%
Fairness	Gini coefficient		31.5	(2017)	25

***Source*:** Compiled from Table 1 in Report Appendix.

Trade-offs to agroecology can be found in some of SADS projects. As an example, is the horizontal expansion mega projects which aim expand the cultivated area of Egypt by about 1.5 million ha in the desert representing about 40 percent of the total cultivated area. Whereas it creates jobs and livelihoods for landless families, it will at the same time increase the pressure on the already scarce water.

National Climate Change Strategy (NCCS) 2050

Projects:

Project 1: Enhancing agricultural production for adaptation to climate change in the Valley and Nile Delta regions.

Location: The Valley and Nile Delta regions

The overall objective is to enhance smallholder farmers adaptation to the impacts of climate change risks in Nile Delta and valley.

Specific project objectives include:

- To promote agricultural diversification for food and income security,
- To promote proven practices and measures for sustainable natural resource use and management,
- To single out the need to develop new areas and explore and disseminate water-efficient and heat resistant crops and production methods,
- To reduce the expected risks of climate on major crops productivity, animal production, and fisheries,
- To enhance smallholders' capacity to influence policies of climate change,
- To enhance rural communities' responses to disasters and impacts induced by climate change.

Project 2: Rehabilitation of Agricultural Areas in Northern Delta Affected by the Repercussions of Sea-Level Rise.

The overall objective: To enhance the adaptation of smallholder farmers to the risks of the SLR impacts in the northern part of the Delta.

Specific project objectives include:

- Enhance smallholder capacity to influence policies on sea-level rise,
- Enhance rural communities' responses to disasters and impacts induced by sea-level rise,
- Promote agricultural diversification for food and income security,
- Reduce the rate of internal migrations from these areas towards the cities or towards other agricultural areas far from the homeland of these farms.

Project 3: Increasing the resilience of climatically vulnerable areas through combating desertification, water harvesting and rehabilitating degraded pastures in marginal areas.

Location: The Desert and marginal regions (Oasis, Moghra, Sinai, southern east part of Egypt …etc.)

The overall objective: Increasing the resilience of climatically vulnerable areas through specific interventions aiming to improve farmer's livelihoods.

Project specific objectives include:

- Develop rainy areas and integrate them into comprehensive agricultural development system and social and economic focus,
- Develop valleys and ecosystem applications, and increase their productivity and quality,
- Provide farmers with the necessary technical support to adopt modern irrigation and crop management,
- Develop sheep and camel production in a sustainable way,
- Overcome local faults in managing, maintaining and rehabilitating pastures in a sustainable manner,
- Combat desertification in rainy areas,
- Expand and develop agricultural industrialization programs for figs, olives, dates and other crops for local marketing and export, developing environmental industries, developing packaging operations for medicinal and aromatic plants, whether they are cultivated or collected, establishing factories to extract their oils and pharmaceutical supplies, and improving and developing industries based on sheep's wool,
- Develop the fisheries sector in coastal areas, raising awareness of the fishing process, and establishing factories for processing and preserving fish,
- Assist local communities in planning and implementing their developmental activities and enhancing their confidence in dealing with and attracting investors and businessmen to their areas,
- Follow-up and evaluate the developmental programs implementation, conservation and management of natural resources in rainy areas in a sustainable manner.

Project 4: Development of on-farm Irrigation in the old Valley and the Delta

Location: Old Valley and the Delta areas

The overall objective: To raise irrigation efficiency from 50 to 70% through the development of on-farm irrigation for some vulnerable areas in the old lands of Nile Valley and Delta.

Specific project objectives include:

- Preserve and conserve natural resources mainly water, energy, and land resources.
- Save an area of 2-3 % of agricultural land using old surface irrigation and hence increasing the economic return at national and farm levels.
- Prepare a crop pattern for water consumption by maximizing the return of the area and water unit.
- Save water resources significantly will increase yield as a result of transforming from flood to modern irrigation.

Project 5: Rehabilitation of Irrigation Canals to Enhance Agricultural Climate Resilience.

The overall objective: Improve climate resilience of agriculture by means of improving operation and control in the irrigation canal networks. This implicitly leads to raising water conveyance efficiency, reducing losses in the delivery system, and increasing water productivity under water scarcity conditions.

Project 6: Scaling-up Solar Pumps for Irrigated Agriculture.

The overall objective: Up-Scaling the use of solar pumps by small farmers and rural remote communities in Egypt in order to:

(i) Reduce carbon dioxide emission,

(ii) Avoid negative impacts of future energy crisis & impacts on food production,

Project 7: Improve Agricultural Climate Resilience by Modernizing On-Farm Practices

The overall objective: Improve Climate Resilience of Agriculture by means of sustainable modernization of the on-farm irrigation systems. This implicitly leads to raising water efficiency and productivity under water scarcity conditions.

Financing the strategy

The potential sources of funding for the strategy include both international and local sources. Under the framework of the United Nations Convention on Climate Change and the Paris Agreement, the international sources comprise the Green Climate Fund, banks and multilateral institutions such as the World Bank and the African Development Bank, in addition to parties such as the French Development Agency and others. Local sources include country's budget and private sector investments in the respective fields. The below table presents the estimated costs of NCCS projects in the agriculture and water sectors and estimated costs.

Table 21: Egypt's NCCS projects in the agriculture and water sectors and estimated costs.

Sector	Project	Estimated costs **(USD million)**
Agriculture	Adaptation of crop production in the Nile Valley and Delta	800
	Adaptation of the Northern Delta affected by Sea Level Rise (SLR)	400
	Resilience for most vulnerable and marginal regions	800
	On-farm irrigation in old lands	950
Water	Rehabilitation of irrigation canals to enhance agricultural climate resilience	730
	Scaling up solar pumping for irrigation	50
	Improve agricultural climate resilience by modernizing on-farm practices	750
Total		**4480**

***Source*:** The National Climate Change Strategy, 2050.

Strategy for Managing Water Scarcity – National Water Resources Plan (NWRP 2017-2037)

Projects of the NWRP:

Pillar 1: Water Quality

Projects included are as follows:

(i) Treating sewage water, industrial water and wastewater,
(ii) Controlling pollution,
(iii) Managing solid waste
(iv) Treating groundwater

Pillar 2: Water Conservation

Projects included are:

(i) Rationalizing crop cultivation (through modifying the cropping pattern in favor of crops that consume less water).
(ii) Increasing irrigation efficiency,
(iii) Investing in farm technology (examples: a sensor was developed to measure the degree of land irrigation for farmers to cut down on excessive water use),
(iv) Improving water management,
(v) Optimizing the population's water consumption,
(vi) Aggregating small land tenures into bigger areas (200+ feddan)

Pillar 3: Water Resources Development

Projects included are:

(i) Desalination plants
(ii) Fresh water harvesting and storage (from flash floods among other sources)

Pillar 4: Raising Awareness

(i) Capacity building Awareness campaigns
(ii) Media presence

Trade-offs and leverages to agroecology

NWRP deals with the water sector at large including water use in the agricultural sector, that is irrigation water, as well as water use in non-agricultural sectors. Objectives of the projects under Pillars 1 and 2 dealing with water quality, water conservation, respectively, are strongly related to the principles of agroecology. In general, the projects under pillar 1 are consistent with the principles of recycling and diversification which emphasize conservation of natural resources and use of local renewable resources.

Egyptian Biodiversity Strategy and Action Plan (EBSAP) (2015-2030)

Projects of EBSAP related to agroecology

The Report Appendix in section 6.6.2 presents the Strategic Goals and targets (indicating projects, measures, and activities). Out of the six SGs presented, Strategic Goal 2, i.e. Sustainable use of natural resources, is the most related to agroecology particularly the target that deals with the adoption of ecologically sustainable

agricultural management practices, including control of fertilizers and pesticides. Also, Strategic Goal 4 (below) includes some measures that are related to agroecology.

Strategic Goal 2: Sustainable use of natural resources

T5: By 2020, Conservation of natural resources through the adoption of ecologically sustainable agricultural management practices, including control of fertilizers and pesticides.

T8 a: By 2025, negative effects of different sectoral policies (land-use planning, transport, energy, uncontrolled urbanization, etc.) on priority elements of biodiversity are minimized, and measures to correct these effects are applied through developing and implementing land use management plans.

Strategic Goal 4: Improve our understanding of biological diversity and ecosystem functioning in a changing environment

T12: By 2020, the knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied

T13: By 2030, Research and implement measures and strategies to strengthen local- level biodiversity resilience.

T14: By 2020, enhancing environmental awareness of Egyptians of the importance of biodiversity and ecosystem services through integrating environmental themes into university and school curricula, promoting green media, and supporting youth clubs and eco-industry.

Synergies and Trade-offs to Agroecology in the Context of EBSAP

The EBSAP is a strategy designed basically to the biodiversity in Egyptian environment, so naturally, the projects, measures and activities included are all concerned with the introduction of biodiversity concerns and priorities into the mainstream of the Egyptian agriculture emphasizing the principles of agroecology.

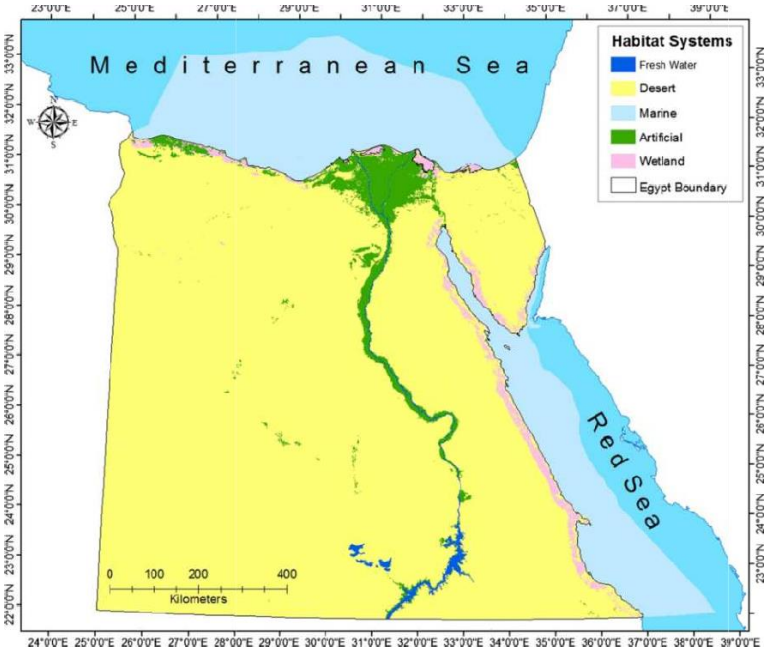


Figure 15: Map of Habitat Systems along Egypt.

Source: MoSE, 2016

National Action Plan to Combat Desertification (NAPCD):

Programmes and Projects

Programme for Irrigated Agriculture

The overall objective of this programme is the modernization of Egyptian Agriculture in the Nile Valley and Delta through increasing the agricultural productivity per unit water and land upon efficient use of these resources, cultivating high – yield varieties and reducing the unit cost of production, thereby alleviating poverty in such dense population zone.

The program relies on two main sectors i.e. water resources and land resources. For the water resources, Egypt has practiced the irrigated agriculture since long time ago and learnt how to control and manage the Nile water through an intense irrigation and drainage networks. As the water quota is now below 1000 m3 per capita/year, water availability is considered a primary stress to all activities.

Associated projects:

- Irrigation Improvement
- The Integrated Irrigation Management Project (IIMP)
- Land Improvement management
- Water and Land Pollution Control
- Environmental Pollution in Wadi El-Rayan Depression.
- Safe use of treated sewage water for Afforestation

Programme for Rehabilitation, Conservation and Sustainable Use of Range Resource

The ultimate aim of this programme is not only to arrest degradation of the rangelands and to improve its production through the application of some measures (i.e. protection of range, reducing population of grazing animals … etc.), but the main purpose of all activities of the programme is to arrive at realistic management approach. The primary objective of this approach is to maximize sustainable production from rangelands by maintaining its long-term productivity (use within carrying capacity).

Associated projects:

- Artificial Revegetation of Depleted Ranges
- Conservation of Soil and Water Resources-
- Grazing Management

Programme for Rainfed Agriculture

Objectives of the program are as follows:

- Formulation of a master plan for fixing sand dunes, including priorities and hot spots for phasing activities.
- Adopting and executing the most efficient and economically feasible techniques for dunes fixation.
- Providing training and other elements of capacity building on personnel, institutional and community levels.

- Securing the participatory role of all relevant stakeholders in the various processes of planning and implementation of the programme.

Associated projects

- Land Use Planning
- Experimental Cloud Seeding under Egypt is Conditions
- Improving livestock Performance
- Improving Small Ruminants Production in North Sinai.
- Soil Erosion Control

Programme for Sand Dunes Stabilization

- Control of Sand Encroachment on High Dam Lake
- Stabilization of Dune Sands in Siwa Oasis.
- Stabilization of Shifting Sand Dunes in North Sinai
- Control of Sand Encroachment on High Dam Lake

Synergies and Trade-offs to Agroecology in the Context of NAPCD

Generally, the programmes and associated projects suggested under NAPCD are consistent with the principles of agroecology. It should be noted however, that there are some critical constraints that could be obstacles to the development of agroecology. The following the most important of these constraints:

- Lack of clarification regarding land tenure and processes for resolving conflicts over access to rangelands dry and rained areas may provide insufficient security for pastoralists and farmers to invest their time and efforts in constructing soil conservation and land use measures.
- Poor integration of environmental, social and economic policies to conserve and improve natural resources.
- Lack of well-defined and clear land use systems (pattern, policy, or plan) of arid and semi-arid areas that strike a proper balance between the various land use options without undue loss of environmental sustainability (e.g. range, rainfed cropping, tourism…etc.).
- Social driving forces linked to land degradation need to be mitigated economically especially in regard to poverty alleviation or eradication until sustainable biomass production strategies recover their problems.
- Lack of infrastructure in some remote decertified areas.

The actors responsible for implementation of the strategies adopted

The actors responsible for implementation of the five strategies presented above are diversified between private, public, semi-governmental, NGOs, and international institutions. We mean by the private actors, the farmers of different types, large investors, and agricultural companies. Ministries of Agriculture and Land Reclamation, Water Resources and Irrigation take the lead with respect to SADS, NWRP, and NAPCD, whereas Ministry of Environment has the main responsibility regarding NCCS and NBDS.

Public Institutions

- The Ministry of Agriculture and Land Reclamation (MALR)
  (The Agricultural Research Centre (ARC), The Desert Research Centre (DRC) and other institutions and agencies affiliated to the MALR)
- The Ministry of Water Resources and Irrigation (MWRI)
  (National Centre for Water Research (NCWR) and other institutions and agencies affiliated to the MWRI)
- The Ministry of State for Environmental Affairs (MSEA)
- The Ministry of Social Affairs
- The Ministry of International Cooperation (MIC)
- The National Research Centre (NRC) (Branch of Agriculture)
- National Service Agency (NCA) of the Armed Forces
- Academy of Scientific Research and Technology (ASRT)
  (Council for Agriculture and Food Researches, Council for Water Researches)
- Egyptian Agricultural Bank (EAB)
- (It has 4000 Village Banks located in 4000 major villages)
- Union for Producers and Exporters of Horticultural Crops (Affiliated to the MALR).

Unions and cooperatives

- Central Union for Agricultural Cooperation (CUAC)
  (It has 6900 agricultural cooperatives located in the villages)
- Seeds Association
- Union for Poultry Producers (UPP)

National and International NGOs

- Coptic Evangelical Organization for Social Services (CEOSS)
- CARE International (Egypt)
- Masr El-Khair

International Institutions Financing and Participating in Agroecology related Projects in Egypt.

- World Bank (WB)
- European Union (EU)
- Food and Agriculture Organization (FAO),
- USAID
- ICARDA
- CEDARE
- CGIAR Research Program on WHEAT,
- International Maize and Wheat Improvement Centre (CIMMYT),
- CGIAR Research Program on Policies, Institutions, and Markets (PIM),
- International Food Policy Research Institute (IFPRI),
- CGIAR GENDER Platform,

- International Livestock Research Institute (ILRI),
- German Federal Ministry of the Environment,
- Nature Conservation and Nuclear Safety (BMU),
- Arab Fund for Economic and Social Development (AFESD),
- OPEC Fund for International Development (OFID),
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ),
- International Water Management Institute (IWMI), and
- CGIAR Research Program on Water,
- Land and Ecosystems (WLE).
- The Development Partners Group (DPG): consists of key bilateral and multilateral donors, including: the IMF, the World Bank, the European Bank of Reconstruction and Development (EBRD), the United Nations and its agencies, as well as the United Kingdom, Germany, France, Swiss Cooperation, Korea, Japanese International Cooperation Agency (JICA), and other development donors.
- USAID/Egypt Country Development Cooperation Strategy 2020-2025

Table 22: International Institutions Financing and Participating in Agroecology related Projects in Egypt.

International funders	Program/project	Scope/objective	Start-end date
FAO	Sustainable Agricultural Investments and Livelihoods (SAIL).	The goal of the SAIL Project is to 'reduce poverty and increase food and nutrition security for poor rural women and men in the New Lands of Egypt'	
	Developing Irrigation system capacity building & finding innovated solutions by using solar power in Egypt	The overall objective : enhancing farmers livelihood by reducing facing the side effect of power shortage , by offering trusted economic power source ,so keeping having high agriculture production & saving the water resource as well	Implemented period: 2019 to 2021
IFAD			
USAID	Climate Smart Agricultural Development Activity	The purpose of Egypt CSA is to strengthen the competitiveness of the agricultural sector while promoting a climate smart food and agriculture system. The Activity will build upon past and ongoing investments from USAID, the Government of Egypt, and other donor partners to incentivize private sector investment, promote market-oriented climate smart technologies, and strengthen the resilience of smallholders.	
GIZ	Nile Delta Water Management Programme	The framework conditions for an efficient water use in water and sanitation as well as irrigated agriculture in the Nile Delta are improved.	2021 to 2024
GIZ	Agricultural Innovation Project (AIP)	Incomes in small-scale agriculture in Upper Egypt are increased through agricultural innovation.	2020 to 2023

GIZ	Egyptian-German Joint Committee on Renewable Energy, Energy Efficiency and Environmental Protection (JCEE)	Improvement of Egyptian frameworks and operational conditions for reduction of Greenhouse Gas intensity of electricity supply and demand in Egypt. JCEE enables sustainable electricity production and consumption in Egypt through supporting measures in renewable energy and improving, energy efficiency and climate change mitigation.	2019 to 2023
Germany's I nternational Climate Initiative (IKI).	Scaling up Climate Ambition on Land Use and Agriculture through NDCs and NAPs (SCALA)	improve institutional and technical capacity for climate change planning and enhance Egypt's climate action by 2030, by supporting climate risk and vulnerability assessments. In addition, the SCALA programme provides the opportunity to enhance multistakeholder engagement (from private sector, research entities, civil society, etc.) and strengthen strategic partnerships with other international organizations working in these areas.	
JICA	Improving Small-scale Farmers' Market-Oriented Agriculture Project" (ISMAP)	SMAP Approach focused mainly on capacity development of small-scale farmers to practice "farming as business", and change their mindset from the traditional "grow and sell" concept to "grow to sell" concept. It also developed a unique approach to address rural women in the targeted areas, considering their needs to contribute to their household economy, in light of the traditional social norms of Upper Egypt	

FAO-Supported, Canadian financed Project:

The promotion of climate-smart agriculture and agricultural biodiversity

FAO supports the promotion of climate-smart agriculture and agricultural biodiversity in 3 governorates. The project is Canadian funded and implemented in cooperation with the Ministry of Agriculture and Land Reclamation and focuses on rural women. The project is in line with the priorities of the Egyptian government regarding improving agricultural productivity and sustainable use of natural and agricultural resources, better production and a better environment through innovation for sustainable agricultural production, equitable access for small producers, as well as adaptation to the effects of climate change and mitigation through the application of integrated, sustainable and resilient agricultural and food systems.

6.3.4. Existing skills and information in the field of agroecology

6.3.4.1. Scientific Skills

There are no scientific skills specialized specifically in the agroecology. However, there several researches (including M.Sc. and Ph.D. graduates) specialized in organic agriculture in Egypt. In addition, agricultural researchers in the different fields (agronomists, livestock specialists, etc.) generally have some information regarding principles of agroecology. The total number of agricultural researchers in Egypt, is 16,800, 70% of which exist in the Ministry of Agriculture and Land Reclamation and the remaining are distributed among the

other agricultural and water scientific bodies. The Ministry of Agriculture and Land Reclamation (MALR(encompasses 12000 researchers affiliated to four scientific bodies; i) the Agricultural Research Centre (ARC) encompassing 15 Research Institutes and 4 Regional research stations, agroecology specialized labs include Central Laboratory for Organic Agriculture and Central Laboratory of Agricultural climate, ii) the Desert Research Centre (DRC), iii) the central laboratories (12) one of which is the Central Laboratory for Organic Agriculture (CLOA),and iv) agricultural Extension Canters. The remaining number of researchers is affiliated to two ministries; the Ministry of High Education and Scientific Research (the National Research Centre (NRC) (the Agricultural Branch) and the Ministry of Water Resources and Irrigation (MWRI) (The National Research Centre for Water Researches).

6.3.4.2. Technical Skills

With the exception of the field of organic agriculture (adopted in 3% of total agricultural land in Egypt), there are no specific technical skills related to agroecology. In terms of agricultural extension in Egypt, although the administrative body is still the same for more than two decades ago, the number of (Agricultural Extension Workers (AEWs) decreased from more than 9000 in 2007 to about 600 in 2022 due to ceasing hiring them 1986. About third of the capacity of the agricultural researchers in the ARC is dedicated to agricultural extension activities. Coordinated extension projects between MALR and international institutions.

Extension activities provided by the Ministry of Agriculture and Land Reclamation: Extension is one of the main activities of the Ministry of Agriculture and Land Reclamation in Egypt. This sector has different "Central Departments" which have about 2600 extensionists providing extension services particularly in the form of “national extension campaigns”. In addition to those specialized extensionists, research staff at the Agriculture Research Center (ARC) must allocate 30 percent of their time to extension activities.

Collaborative activities between research center staff and extension staff perform activities, covering different crops and livestock activities, including “National Campaigns” specific for strategic crops, training programs for agronomists and their assistants, Extension meetings and lectures, “Field Days”, and Farmers’ Field Schools (FFS).

The above mentioned MALR’ extension activities, particularly the National Extension Campaigns, concentrate on the so called “strategic crops” which are mostly related to food security including wheat, maize, rice, oilseed crops and sugar crops. Little efforts of these campaigns is directed to cotton as well as some major horticultural crops such as potatoes, tomatoes, onion and citrus. The focus of the campaigns is on the improved farm practices that increase crop productivity particularly pest control, fertilization and irrigation.

Coordinated extension projects between MALR and international institutions: There are four coordinated projects based on Farmer’s field schools (FFS): i) Egypt-Finland Agriculture Research Project in Ismailia Governorate (East Delta), ii) German Technical Cooperation in some governorates of North and Middle Egypt, iii) Integrated Pest Management Project in Fayoum, and iv) Capacity building in land management and soil productivity/soil productivity improvement through FFS in Fayoum Governorate and Nubariya Region (TCP/EGY/2904, FAO).

There are four scientific institutions involved in agroecology-related Researches including 2 Public institutes; Institute for Environmental Studies (IES), El-Areesh University, El-Areesh, Sinai (post-graduate, M.Sc. and Ph.D.) and Institute for Environmental Studies (IES), Ain Shams University, Cairo, (post-graduate, M.Sc. and Ph.D.), as well as other 2 private institutes; Faculty of Organic Agriculture, Heliopolis University for Sustainable Development, Cairo, and Center for Applied Research on the Environment and Sustainability (CARES), Heliopolis University for Sustainable Development, Cairo

FAO - supported projects in the field of extension services: i) Digital Agriculture Extension and Communication Services Project, ii) Strengthening of the Horticulture information Support Network for Small Farmers in Egypt (HORTISUN), ii) Rural Agricultural Development Communication Network (RADCON), iii) Development of a National Agricultural Research Information Management System (NARIMS), iv)Virtual Extension and Research Communication Network (VERCON)

https://www.fao.org/egypt/programmes-and-projects/infosys/fr/

Project for Sustainable Management of Agroecology: Recently, the FAO is implementing a project for sustainable management of agroecological systems in "Kharga Oasis" in New Valley Governorate, providing local communities and smallholders with technical capacity, financial means, knowledge and support to plan and manage land and water resources and agricultural biodiversity sustainably. The project is implemented in cooperation and coordination with the Ministry of Agriculture and Land Reclamation (MALR) , the Desert Research Center, and the New Valley Governorate. The project executed 105 Farmer Field Schools that benefited farmers in learning new agricultural practices for the fava bean, wheat, tomatoes, and fodder crops, resulting in high productivity, as well as learning new methods for producing organic fertilizers (compost) and pest control. (https://news.un.org/ar/story/2023/09/1122287).

Private sector initiatives for the development of agroecology: SEKEM is an Egyptian private company which has by now reclaimed close to 700 hectares of desert land, of which 100% is operated by biodynamic agriculture methods and whose products respect highest possible ethical, ecological and social standards. More than 70% of SEKEM's reclaimed land produces food and raw materials for the local market.

https://www.fao.org/agroecology/slideshow/news-article/ru/c/1235193/,

https://www.worldfuturecouncil.org/press-release-opa-2019/

6.3.4.3. Information on Agroecology

With the exception of some information available about organic agriculture in Egypt, there is no any type of information that is specialized in agroecology. Instead, all types of agricultural information are general, yet specialized according to fields of agricultural production; crops and livestock. The Central Administration for Agricultural Extension and Environment (CAAEE) in collaboration with the Research Institutes (of ARC) produces about fifteen agricultural extension guidelines concerning different crops and livestock.

The most important types of general agricultural information include the following***: i) Periodical Agricultural magazines***. There are four periodical agricultural magazines including : The Agricultural Extension Magazine, the Agricultural Extension in New Lands Magazine, published by the CAAEE, The Agricultural Newspaper

Magazine, The Agricultural Thought Magazine, published quarterly by the General Administration of Agrarian Culture (GAAC) (Diab, 2017).***ii) Technical Extension Guidelines***; including fifteen technical guidelines specialized in various agricultural activities and animal production, published by the Central Administration for Agricultural Extension (CAAE) and the General Administration for Agricultural Culture (of MALR), in cooperation with the Agricultural and Desert Research Center (of MALR). These guidrlinrs aim to encourage farmers to follow good agricultural practices, to achieve the highest crop productivity, and thus improve their income and livelihoods. Guidance bulletins provides farmers with the improved agricultural practices such as preparing soil, choosing seeds suitable for each region, planting, methods of cultivation, plant care, irrigation, fertilization, pest control, harvest. Also, they provide farmers with information related to the diseases that infect the crop and how to treat them. With regards animal production, bullitens deal with choosing good varieties and breeds, and appropriate breeding methods

6.3.5. Obstacles to agroecology

As has been clarified in the context of Sec.2, the analysis of the documented strategies showed that no obstacles or contradictions to agroecology have been found in these strategies in terms of their objectives or connected projects. Moreover, Some of these objectives and projects are consistant with some of agroecology principles. But several obstacles show clearly at the implementation of policies, particularly when applied projects and policies deviate from documented strategies and policies. In addition to the deviations at the policy implementation level that create obstacles to the development of agroecology, these obstacles are also impacted by the differences between the two main ecological zones; the Old and New lands. There are many differences between the two zones in terms of soil characteristics, availability and quality of water resources, and social and economic context. These differences have deeply impacted the cropping pattern, agricultural practices, productivity, and the farming and food systems which, in turn, reflected on the level of adoption of agroecological approach. Furthermore, applied policies have implicitly affected agricultural production in the two zones, thus intervening with the factors that determine the type of farming approach adopted by farmers, investors, and companies. Some of the implemented policies either representing obstacles as to both sustainable agriculture and agroecology principles are summarized as follows:

6.3.5.1. Provision of irrigation water free of charge

Providing irrigation water free of charge would encourage farmers to over use irrigation water , especially in the case of flood irrigation method, which is adopted in more than 2.5 million ha or 64% of the total cultivated area. It should be noted however, that pricing irrigation water is a sensetive and complicated issue socially and economically taking into consideration the structure and characteristics of agriculture in Egypt.

6.3.5.2. Weak expenditure on R&D and lack of agroecology scientific innovations

In addition to the abscence of agroecology in the national research agenda, Egypt lacks knowledge in the field of alternative technologies as a result of the weak expenditure on research and development (R&D) in the field of agroecology and natural resource conservation. Ideas rejecting ecological solutions still prevail and agricultural research centers continue to adopt the notions of intensification and others, which often ignore

environmental degradation and could lead to catastrophic problems on the long and medium run. The scientific challenge entails transforming the scientific culture of agricultural researchers and supporting multi-disciplinary research on agriculture, the environment, and food.

6.3.5.3. Lack of advisory and extension services

Weakness of advisory and extension services is represented in several aspects: (a) Ineffective performance of extension personnel, associated with limited resources and ever-decreasing numbers of extension workers, (b) Lack of trust of agricultural producers in extension agents, especially farmers producing highly specialized crops or those engaged in sophisticated farming activities, (c) Lack of mutual relationships between research and extension workers in addition to lack of involvement of university staff and technicians in extension work, (d) unfair salaries of extension workers, especially Village Extension Workers (VEWs). On the other side , there is a clear gap between views of extension workers and farmers about service quality provided by extension personnel (Diab et al,2020). With ceasing hiring of fresh graduate extension staff since 1986, the total number of agricultural extension staff in Egypt has been decreasing continuously since then with more staff retiring. By 2007, this number was 9658, then decreased to 2503 by 2018 indicating that the extension system lost about 74.1 per cent of its manpower within only 10 years (Diab et al, 2020). The majority of the remaining extension workers are about 600 in 2022, and are all expected to retire by 2027.

6.3.5.4. Weak cooperatives

Currently, there are about 7000 multipurpose agricultural cooperatives spread in villages throughout rural Egypt having more than 4 million members (CAPMAS). The main role of these cooperatives is basically to provide their members with diversified services among which, providion of inputs, organization of production, facilitate access to market information, collective marketing of outputs, as well as technical assistance, and supply chains for exports (Christiansen et al. 2011). However, the effectiveness of cooperatives in playing this role is questionable. One of the major limitations of the existing cooperatives' structure is inflexibility in allowing them to develop independent marketing activities (World Bank 2014). The lack of strong cooperatives representing small holders together with their low level of political participation may explain why development strategies and policies tend to be biased in favor of urban activities. Furthermore, with lack of effectiveness of cooperatives, small farmers lack access to technology and inputs as well as market, thus missing the opportunity to retain a larger share of value added and to enjoy the advantages of collective work and economies of scale. As such, the current cooperative set-up is not convenient to incubate and support agroecology -related activities within an integrated farming systems.

6.3.5.5. Lack of Information

One of the most limiting constraints to the agroecology is the lack of information. As has been mentioned, the information available is belonging to the agricultural intensification techniques rather than to integrated farming systems. Furthermore, the officially issued agricultural data concerning crop and livestock production is suspected by experts in terms of accuracy.

6.3.5.6. Provision of price-subsidized nitrogenous fertilizers to farmers

Nitrogenous fertilizers are provided to farmers by government at a subsidized price of 50% of the real price. Specific quantities are determined for different crops per area unit (fed), ranging between 3-8 sacks depending on the type of crop,. There are three types of nitrogen fertilizers: urea (46.5% nitrogen), ammonia sulfate (15%), and ammonium nitrate. For example, 3 bags of urea per acre are set for wheat, 4 sacks of urea for rice and corn, and the rate rises to 8 sacks for fruit and vegetable crops. Naturally, this encourages farmers to use larger, than recommended, quantities of fertilizers. Indeed, many farmers use additional quantities of these fertilizers, convinced, in the absence of agricultural extension, that larger quantities of these fertilizers entail an increase in crop productivity.

6.3.5.7. Expanding the use of certified seeds

Currently, certified seeds are used in about 40% of the wheat cultivated area, while for the remaining 60% of wheat area, farmers use seeds retained from the preceding season. The Ministry of Agriculture and Land Reclamation (MALR) aims to generalize certified seeds in all cultivated areas. This applies, in one way or another, to other crops, including rice, soybeans, beans, clover, and some other crops. As for vegetables, their seeds are imported from abroad.

6.3.5.8. Limited enforcement of policies

Ground water policy

The weak control over the use of groundwater and the lack of control over the establishment of new wells, whether for the deep groundwater in the desert (about 2.5 bcm) or for the shallow groundwater in the Nile Delta (about 7.9 bcm). This has created the problem of overdrawing wells, which led to increase in groundwater salinity, especially the case of renewable groundwater. Many farms have already been affected by this problem. While the “Irrigation Law” prohibits farmers from applying flood irrigation method in the desert lands (the new land), there is an area of about one million feddan-or about 29% of the new land area, in which flood irrigation is used in violation to the law.

Pesticides policy

Weak control over chemical pesticide markets, resulting in the spread of adulterated or low-effective pesticides that do not conform to standard specifications. These pesticides cause many problems for farmers and crop production, especially in the absence of subject matter specialists or other agricultural extension workers. On the other side, there are concerns over the exposure of farmers and agriculture workers to hazardous substances due to limited enforcement of regulations (Fleischer, Waibel, and Walter-Echols 2002).In 2017, a ministerial decree was issued by MALR giving the Agricultural Pesticide Committee additional control over the licensing and regulation of the pesticide industry in Egypt (MALR 2017).

Land tenure policy

a) In the old lands, most holdings are not officially registered, due to many reasons, most important of which, the high registration costs that small farmers with limited financial capacity cannot afford.

Accordingly, non-registered landholdings are dealt with in, buying, selling and renting, informally. Although they are considered stable and safe holdings, they are not acceptable by banks as a collateral for loans, which affect the capability of smallholder farmers in particular to have access to finance.

b) In the new lands, there is also a problem of legalization for many holders, even in a more complicated way, as these holders face lengthy bureaucratic procedures and the need for approvals of several state agencies in order to legalize their holdings. In addition to the fact that there is no specific policy or legislation dealing with legalization of holdings in the new lands. These unregulated holdings are called "seizures." In light of these bureaucratic restrictions and political ambiguity, legalization procedures may continue for a long period, sometimes up to ten years. Therefore, during this period, they remain unstable and unsafe holdings, and thus they are It is difficult to deal with it, buying, selling and renting, even informally.

6.4. Main Results of the Interview Guide with Stakeholders

6.4.1. Methodology

The Objectives of the interview are: i) to explore the level of the perception as to agroecology in the Egyptian context, ii) identify the obstacles and constraints to adopting agroecology, iii) identify the necessary conditions and policies needed to the developing and scaling-up agroecological farming systems. The methodology used is based on interviewing 43 persons selected from five relevant groups of actors; farmers (18), researchers (11), representatives of public authorities (8), agricultural professions organizations (4), and Non-Governmental Organizations (2) (Report Appendix in section 6.6.3). The interview was structured specifically to fit each group focusing mainly on the agricultural practices in the different farming systems in the two main ecological zones in Egypt, Old lands and New lands. The existing agricultural practices are classified in terms of their relation to agroecology. Further, the scale of adopting the agroecology-related practices is explored and the strategies and policies to scale-up them are identified. Also, the conditions to potentially convert the traditional practices to agroecological practices are clarified taking into consideration the socio-economic and institutional characteristics of the context of the farming systems.

The total number of farmers in Egypt is about 6 million, 84 % of which are smallholder farmers (less than 1.26 ha) located in the old land. The average size of this category is about 0.63 ha. At the bottom of this category, lie what we call the "tinny" farms, those are the farms of sizes less than 0.42 ha (1.0 feddan) and averaging 0.21 ha, representing about 40 % of the total number of farmers, i.e., 2.4 million farmers owning about 15 % of the total cultivated land of Egypt.

Table 23: Distribution of interviewed groups of actors in Egypt.

Groups of stakeholders	Number
Farmers	**18**
Researchers	**11**
Ministerial officials	**8**
Agricultural Professions	**4**

NGOs	**2**
Total	**43**

Source: Collected from the Report Appendix in section 6.6.3.

The eighteen farmers interviewed have been selected in such a way as to represent, as much as possible, the different types of farming systems connected with different classes of holdings in the two main agroecological zones, i.e., the Old Lands and the New Lands. The 9 farmers of the Old Land are located in 3 Governorates; one farmer of each of the 3 categories is represented in the selected governorates. The approach to analyse the farmers' perception of agroecology is based on identifying the different farming systems focusing on the main characteristics and connected agricultural practices that are currently applied. Of these practices, the ones that could be considered agroecological will be identified, whereas the remaining practices will be discussed in terms of the potentiality to convert to agroecology. As to the existing agroecological practices, the scale at which they are adopted will be clarified. Further, the conditions needed to either scale up agroecological practices or to introduce new practices for the different farming systems will be identified.

Table 24: Distribution of interviewed farmers according to farm-size categories in Egypt.

	Old Lands[1)]	New Lands	Total
Small farms	**3**	**3**	**6**
Medium farms	**3**	**3**	**6**
Large farms	**3**	**3**	**6**
Total	**9**	**9**	**18**

1) *Represented by 3 Governorates; Kafr El Sheikh, Fayoum, and Beni Sweif in each of which the 3 categories are represented.*
2) *Represented by 3 Governorates; Esmaelia, Suiz, and Beheira, in each of which the 3 categories are represented.*

***Source*:** Collected from the Report Appendix in section 6.6.3.

6.4.2. The actors' responses:

6.4.2.1. Farmers

Small Farmers

We interviewed three farmers of the Old Lands with farm sizes of 0.25, 0.5, and 1.0 ha. Interviews show that these farmers have specific characteristics. The family is composed of the farmer himself, his wife, and two or three sons. Further, the family has some animals, maybe one or two cows as well as a donkey for drafting. The crops grown are mainly wheat, berseem in the winter season and maize, and rice in the summer season. An improved flood irrigation system is used. In terms of agroecology, small farmers do not know about agroecology, and they have not heard about it. Yet, they do apply several practices that could be related to principles of agroecology but they do not realize them as agroecological practices. It should be noted, however, that these practices are applied on a very limited scale, particularly in the case of tinny-size farms. These tinny farms are

too small to provide a significant contribution to the household food consumption and/or animal feed. They wish they are enabled to adopt the AE hoping it could improve their subsistence livelihood. In this regard, their excess family labour supply could be employed in AE -related activities at the village level, but they miss very much the extension services and representative organization.

Medium farmers

In the Egyptian context, the medium farm is between 1.26-4.2 ha size. We interviewed three medium farmers with 1.5, 2.5, and 4.0 ha sizes. Results of the interviews show that their characteristics qualify them to behave as “family farms” that are more capable to adopt agroecological practices on a larger scale in comparison to small farmers and tinny-size farms., particularly in terms of crop-livestock integration, organic fertilization, and food sovereignty. Crop rotation (at the farm and landscape levels), intercropping, and recycling of farm residues are adopted in a limited scale. Responses show that obstacles to adopt more AE practices in a context of holistic integrated farming system include the absence of technical support services and well representative institutions.

Large farmers

Three large farmers, with 7.0, 10, and 20 ha sizes have been interviewed. Results of interviewing these farmers, indicate that they use agricultural intensification techniques including intensive irrigation, chemical fertilizers, and pesticides in order to maximize profits out of their farms.

Farmers in the New land

In general, the new land is used to be desert soil which is almost free of any organic matter, and it needs so many years of cultivation of a variety of crops until it has relevant content of organic matter, so the farmers of different categories in the new land apply high rates of chemical fertilizers to compensate for the absence of organic matter in the sandy soil. Yet, productivities of field crops in the new land are significantly low compared to the old land. Further, the cost of agricultural production is high in comparison to the old land, particularly because of high labor wages and transportation costs. Therefore, farmers.in these areas prefer to cultivate high-value crops, mainly fruits and vegetables in order to cover up production costs and good profit margin using the agricultural intensification techniques.

Readiness of farmers to adopt a holistic agroecological farming system: The main idea of the holistic agroecological farming system has been explained to interviewed farmers in order to explore their readiness to adopt it. The answer for such question was different according to the category of farmer. For small and tinny-size farmers in the Old Land, their farm income is just a minor component of the household income, where the major part is generated from labour wage either by the family labour force (the farmer himself, his wife and may be sons) working in other farms or in other non-farm activities. Those farmers can make significant improvement in their livelihoods, moving from almost subsistence levels, through engaging this excess family labour force to agroecology-related activities at the village level such as recycling of farm residues, food processing, and post-harvest activities. This needs a substantial institutional arrangement in the context village integrated development scheme.

6.4.2.2. Representatives of professional agricultural organizations

Four representatives of professional agricultural organizations have been interviewed, two of which works in the Old Land, and the others in the New Land. They do not know about agroecology. The majority of the members of the cooperatives in the Old Land are small and medium farmers who grow mostly field crops adopting traditional production techniques, with the medium farmers adopting some agroecology-related practices, yet they do not realize that these are AE (see responses of small and medium farmers above).Cooperatives in the Old Land are very week and are about to face collapse; they are still run and government-controlled by an obsolete Law (1976).Some farmers supported by international doners, try to establish their association but under the Law of National Associations supervised by the Ministry of Social Affairs, which avail higher degree of independence.

6.4.2.3. Researchers

We have interviewed 10 agricultural researchers, of different specializations, regarding their perception of agroecology. These are selected in such a way to be diversified between the most important scientific bodies related to agricultural research in Egypt, including Agricultural Research Centre (ARC), Desert Research Centre (DRC) (both affiliated to the Ministry of Agriculture and Land Reclamation), and Faculty of Agriculture (Cairo University), as well as institute of National Planning. Further, the selected researchers are also diversified in terms of specialization covering the areas most related to agroecology.

Results of interviews show that agricultural researchers, have some knowledge about agroecology mostly from agricultural scientific sources. They are generally in contact with research papers and studies that analyse the differences between types of agriculture including agroecology, sustainable agriculture, climate-smart agriculture and others. They admit that agroecology as an integrated inclusive farming system has not been introduced to the national agricultural research agenda. In addition to the low priority given to agroecology-related research or even non-existence in the national research agenda, the agricultural research in general suffers from severe shortage of allocated budget.

The researchers mentioned that there are several agroecology-related practices that have been conducted as experimental research and proved successful results, but have not been adopted at the farm level within an integrated farming system. These are as follows:

(i) Intercropping practice:

- Intercrop soybeans on maize: conserve soil fertility, biodiversity, raise farmers' income, and integrate crop-livestock. These benefits can be more supported through developing varieties (of both crops) that are more relevant to such practice
- Intercrop sunflowers/sugar beet on sugar beet lines without additional crop service in Lower and Upper Egypt governorates
- Intercrop sunflowers/ early planted vegetables (tomatoes, potatoes, and cucumber) in Middle Egypt governorates.
- Intercrop sunflowers/tomato in the winter season in Upper Egypt governorates and in the summer season in Lower Egypt governorates.

(ii) **Treatment of soybeans with bacteria**: treatment of soybeans seed, before planting, with streptococcal bacteria that have the ability to fix atmospheric nitrogen: The benefits include saving use of mineral nitrogenous fertilizers, reducing production costs and increases farmers' income, preserve ecology.
(iii) **Planting dates and fertilizer rates** (less rate than applied) and seed rates, pest resistance, and rationalizing the use of water. Benefits include raising productivity by about 50%.
(iv) **Varieties resistant to the cotton leaf worm**, achieve more than 1.8-2 tons/feddan, saving the expenses of spraying pesticides and preserving the environment.
(v) **Seed rate and plant density**: The current traditional cultivation of wheat after soil preparation for cultivation, is applied in a seed rate of 60-80 kg per feddan. As for the modern technology, it is cultivation with the system of lining with raised-bed after laser levelling with a seed rate of 30-40 kg. per feddan, about 50% lower than its counterpart in conventional methods, as it is characterized by higher productivity than traditional methods by 20%, as well as saving water by 20-30%.
(vi) **Water-efficient irrigation method for maize**: This method relies on cultivating the early-maturing hybrids that stay only 100 days, from planting to harvest, using mechanical planting method (lines). An efficient reciprocal irrigation system can be applied by irrigating one line and closing the other, thus the irrigation water reaches plants through water seepage between the irrigated lines. Also, fertilization is done automatically on the irrigated line, which leads to raising the efficiency of fertilization and irrigation, optimal distribution of plant fertilization, and no loss of fertilizer with irrigation.
(vii) **Mechanical cultivation(sowing**) maintains the plant density and achieve the highest productivity to achieve the productive capacity of the variety due to higher number of plants per feddan increasing from 25 thousand plants achieving 2.5 tons per feddan to 35 thousand plants achieving more than 4 tons per feddan.

There are agricultural practices that are "debatable" among researchers as to their importance for increasing productivity even though not considered agroecology-related practices. For example, the "certified seeds" supplied by the Ministry of Agricultural and Land Reclamation (MALR) are recommended by some researchers to be used by farmers for higher productivity compared to "local seeds" which are produced by the farmers themselves (retained from the preceding season). However, "local seeds" are preferred from the point of view of agroecological farming.

Other practices stated by researchers as having better opportunity to be scaled up at the farm and landscape levels including: bio-fertilization, crop rotation, IPM, compost, organic fertilizer, recycling farm residues, soil conservation techniques. However, as they also added, specific institutional innovations are needed including: contracting agriculture, commodity councils, value chains, commodity exchange, marketing platforms, Community Based Organization (CBOs), rural food industries, rural infrastructure (electricity, roads, communication, markets, etc.), marketing infrastructure, access to solar energy services.

6.4.2.4. Representatives of NGOs

Two representatives of NGOs have been interviewed, one of the two organizations (CEOSS) has contact with the international donors and know about agroecology, whereas the other (Ahlia) has no such contact and do not know about agroecology. CEOSS implements an initiative through a partnership with the GOE aiming to improve wheat productivity for 150,000 smallholders using recommended inputs. It has the capacity to repeat this kind of partnership to help adoption of agroecology-related practices. "Ahlia" makes use of its capacity to be engaged in horticulture value chain which ensure efficient marketing and reducing losses. The possibility of adopting agroecological practices, from the point-of-view of the interviewed persons, relies on the provision of technical support services.

6.4.2.5. Representatives of public authorities

The agricultural and water policies in Egypt are led by two ministries; the Ministry of Agricultural and Land Reclamation and the Ministry of Water Resources and Irrigation. In addition to designing and implementing agricultural and water polices, the two ministries are collaborating with the international doners institutions in implementing projects in the field of sustainable and agroecology-related agriculture and conservation of land and water resources. Seven representatives have been interviewed; 5 from the Ministry of Agriculture and Land Reclamation, and 2 from the Ministry of Water Resources and Irrigation. Responses show that they know about the basic idea of agroecology but not necessarily its principles. Yet they are generally not fully convinced that agroecology approach could be a better alternative for facing the challenges of increasing food production. In contrary, they think that agricultural intensification is the best approach to raise the self-sufficiency of basic food commodities. On the other hand, some of the representatives realize the importance of agroecology provided that the enabling policy, institutional, and technical support environment is realized. They admit that there are obstacles to sustainable and agroecological development, particularly, in terms of enabling environment and support services as well as the chromonic substantial gap between policy making and research,

6.4.3. Summary of the results of the AE actors' interviews

The below table below summarizes the results of the agroecology actors' interviews according to different categories of actors and focusing five elements including, knowledge of agroecology, the practices related to AE, the obstacles to AE adoption, and the conditions needed for the development of AE.

Table 25: Summary of the results of the agroecology actors' interviews in Egypt.

Category of actors	Knowledge of agroecology	What are the practices related to AE?	What are the obstacles to AE adoption	Conditions needed for the development of AE
Small, tinny-size and tenant farmers	They do not know about AE, also they did not hear about it.	Except the tinny farms (the bottom of the category), they do apply some AE practices that could be related to principles of AE but they do not realize them as AE	Farm size is too small to support the household food sovereignty, integrate crop-livestock. Farm income is just a minor part of the household income, and the major part is realized from wage labour Alternative employment opportunities are lacking because of the limited development of small enterprises and micro-enterprises. Local markets are underdeveloped and marketing infrastructure, such as transport, storage and grading facilities, is poor. Producers' associations are not well organized.	They wish they are enabled to adopt the AE hoping it could improve their subsistence livelihood. their excess family labour could be employed in AE - related activities at the village level, but they miss the extension services, representative organization, and supporting rural enterprises for absorbing the excess supply of labour force

Medium and family farms	Nill, but they do adopt some AE practices	Organic fertilization, crop rotation, crop-livestock integration	obstacles to adopt more AE practices in a context of holistic integrated farming system include the absence of technical support services and well representative institutions.	Provision of agricultural extension services, strengthened farmers 'organization, and supporting rural enterprises Practice such as intercropping can be easily adopted at a large scale; at least 0.5 m ha, (soybeans on maize) , but need Agricultural Extension Workers. Crop-rotation can be adopted at landscape level, but need to be organized collectively through a cooperative
Large farmers	Nill, but they do adopt some AE practices	Organic fertilization, crop rotation, crop-livestock integration	they use agricultural intensification techniques including intensive irrigation, chemical fertilizers, and pesticides in order to maximize profits out of their farms	Policy support Integrate large farmers to a village development scheme which need strong CBOs Support food processing, recycling of farm residues, and composting in which large farmers could be engaged.
New Land				
Small farms	Nil	Nil		
Medium farms	Nil	Nil	Cultivation of reclaimed land in the desert is costly and farmers try to use agricultural intensification to maximize profits and compensate the high costs of production.	
Large farms	Nil, but the exports know about it	Producers exporting fruits, vegetables, and MAPs have to stick to EUROGAP or Global GAP. Also, EGD is expected to be applied	Cultivation of reclaimed land in the desert is costly and farmers try use agricultural intensification to maximize profits and compensate the high costs of production.	
Companies	Know about it, but they do not apply AE	Producers exporting fruits, vegetables, and MAPs have to stick to EUROGAP or Global GAP. Also, EGD is expected to be applied	The objective of these companies is to maximize their profits for which they rely on agricultural intensification techniques	For exporters: enforce the minimum chemical residuals Traceability
Representatives of the public authorities	Know about it, but from the technical side only	NA	Increase of national food production for the local market, minimizing the food gap, and raising the self-sufficiency ratios as well as maximizing agricultural	Unlocking ideological barriers to political recognition of agroecology Strengthen linkages between policy makers and researchers focusing on AE-related scientific studies

			exports have the highest priority.	Policy reforms in terms of R&D, advisory services, finance, information Consider new subsidy policy for nitrogenous fertilizers
Researchers	Know about it, and the agronomists have information about many AE related practices but are not adopted	NA	Lack of enabling environment and support services. Lack of interlinkage between researchers and policy makers	Agroecology should be put as a priority in the national scientific agenda for agriculture. Conduct studies concerning AE farming systems in different contexts and locations Conduct studies to determine site-specific AE sustainable technological packages
Organizations of Agricultural Professions	Nil, but they adopt some AE practices	They make use of collective action for adoption of AE related practices such as recycling of farm residues, contracting, and value chain activities	These organizations are still constrained by an old legislation, so they are dependent on the government	Provide an enabling policy environment and economic support to promote sustainable agriculture and food systems through innovative, integrative and measurable approaches. Issue a new law for agricultural cooperation, Provide extension services
NGOs representatives	Know about it	They make use of collective action for adoption of AE related practices such as recycling of farm residues, contracting, and value chain activities	These organizations have higher degree of independence compared to cooperatives. They work under deferent legislation.	For the NGOs to play more effective role in AE development, they need enabling environment and technical support. Public-private partnership in the fields of promoting rural Micro, Small, Medium Enterprises (MSMEs) related to AE

***Source*:** Results of Author's interviews with the AE actors.

6.4.4. Classification of regions and farms in relation to agroecology

The two main ecological zones of Egypt; the Old land and the New land, and the different farming systems existing in these zones can be classified and ranked in relation to agroecology based on their environmental and socioeconomic characteristics and taking into consideration specific principles of agroecology as criteria for ranking. The agroecology principles considered include, in particular, diversity, economic diversification, synergy, recycling, circular and solidarity economy, resilience, and co-creation and sharing of knowledge.

Accordingly, the classification is conducted in two steps; the first deals with the classification at the regional (zone) level, and second at the farming system level within each zone.

6.4.4.1. Agroecological classification at the regional level

The two regions (zones), the Old and the New, are significantly different in terms of both environmental profile and socioeconomic context, the overall impact of which let ***the Old land region to be closer to agroecology approach than the New land*** **or in other words, the agroecological practices are adopted more in the Old land than in the New land.** AS has been mentioned, the Old land is located in the Nile Valley and Delta, dating back to thousands of years ago, with fertile soil and high organic matter and clay content (50 % clay). Agroecological practices such as crop-livestock integration, crop rotation, intercropping, manure fertilization and others are deeply rooted in the Old land zone compared to the New land. However, flood irrigation system that is practiced in such zone would be considered as disadvantage from agroecology perspective.

The New lands are reclaimed and cultivated in the desert through governmental programs and private sector support throughout the last six decades, the organic matter content of the soil is low, and its texture is sandy (8 % clay). Therefore, more intensive agricultural practices in the desert region are needed to compensate for the lower fertility and less suitable conditions for crops. In the New Lands rotation, larger fertilization rates are used, along with the use of a pumped irrigation system (drip and sprinkler irrigation) as opposed to surface irrigation used on Old Lands. As a result, more fertilizers, diesel and electricity are consumed, as well as irrigation infrastructure. As the Old Lands have slightly higher yields and produce less intensively, they would still be more sustainable. Further, agricultural production in New lands is at lower degree of diversity, economic diversification, synergy, and other agroecology principles compared to the Old lands.

6.4.4.2. Agroecological classification at the farm level

Within each region, farms of different types differ in terms of both range and degree of agroecological practices where farm size plays the most important role. As has been shown above, among the three categories of farmers, the category of medium size farmers is the most involved in agroecology-related practices. As for the other two categories, small and tinny-size farmers is closer to agroecology than the large-size category. This ranking could be applied to both regions.

Medium-size farms: these farms behave as “family farms” that are more capable to adopt agroecological practices on a larger scale in comparison to small farmers and tinny-size farms., particularly in terms of crop-livestock integration, organic fertilization, recycling, and food sovereignty.

Small and tinny-size farmers: their farm income is just a minor component of the household income, where the wage labour constitutes the major part of the household, the family labour work in either other farms or in other non-farm activities.

Large-size farmers: they are profit maximisers through adopting agricultural intensification techniques, and large exporters of fruits and vegetables, particularly in the New land, have to commit to specific standards (EUROGAP, GLOBAL GAP, EGD) are even encouraged by government export subsidy.

The below table presents the results of the classification and ranking analysis above. As shown in the table, all farms od different types of the Old land are ranked first followed by farms of the New land. Within both the two zones, medium farms are ranked first, followed by small farms, and large farms come last.

Table 26: Classification of regions and farmers categories in relation to agroecology in Egypt

Region/category	Objective/strategy/characteristics	Rank
Old land-medium farms	Household livelihood improvement, crop-livestock integration, food sovereignty	**1**
Old land-small farms	Secure subsistence for the family, too small to support family consumption, rely more on wage labour to secure the major part of income	**2**
Old land-large farms	Profit maximization, agricultural intensification	**3**
New land-medium farms	Producing high value crops, monoculture	**4**
New land-small farms	Producing high value crops, monoculture	**5**
New land-large farms	Profit maximization, exportation, agricultural intensification, monoculture	**6**

Source: Compiled by the author

6.5. Conclusion

1. Egypt lies in a semi-arid area and has a total land area of about one million km of which only 4 % is arable, with estimated population of 104 million. With this large number of populations, Egypt has a limited base of natural resources consisting of about 4 million ha of agricultural land and 59.7 bcm of renewable water resources annually, with per capita land of 0.04 ha and per capita water of 574 cm.
2. As a result of such imbalanced relationship between population and natural/agricultural resources and continuing population on these almost constant resources, Egypt's food situation has drastically deteriorated. Currently, agriculture sector produces only 40% of Egypt's needs of food, thus importing 60% of these needs from world food markets.
3. In response to the above-mentioned challenge, policies that have been adopted throughout the last six decades, have focused on two paths; first, increasing land productivity through agricultural intensification techniques that maximize agricultural production in order to match the increasing food demand as well as to export some of world market competitive crops for collecting foreign currency, second, expanding the cultivated land area through reclamation of the desert and adding more to New land aiming to support food production and increase agricultural exports, as well as absorbing part of the increasingly intensive rural population living on the limited area of the Old land.
4. The strategies adopted; Sustainable Agricultural Development Strategy (SADS) (2030), National Water Resources Plan (NWRP) (2017-2037).and National Climate Change (NCCS) (2050), did not mention "agroecology" explicitly. However, these strategies have some objectives and connected programs and projects that are related to basic principles of agroecology. Most of these objectives and connected projects are related to water issue including projects of irrigation water rationalization, drainage water

reuse, and water quality conservation. There are also projects relating to supporting small farmers resilience, and recycling of farm residues.

5. In the Egyptian context, the development of agroecology is faced with a number of obstacles. ***First***, in addition to the limited land and water resources, landholdings are characterized by extreme fragmentation meaning that significant portion of farms are partitioned to two plots or more which weakens the integrity of farms. ***Second***, the dominance of small and tinny farms, is a major chronic problem and recognized as an impediment to agricultural development in Egypt. The average farm size in Egypt's agriculture is 0.92 ha. The small and tinny-size farm (holdings) less than 1.26 ha account for 84% of total holdings including the tinny farms (less than 0.42 ha with an average of 0.21 ha) accounting for 40% of total number of holdings. Noting that the farm size is an important factor in determining the capacity of agroecology, the tinny farms are too small to support the household food sovereignty or maintain crop-livestock integration. The tinny piece of land (0.21 average) generates only around 20% of the household livelihood, whereas the remaining 80% is achieved by the family labour working for wage in other farms or non-farm activities. In addition, it cannot afford feeding even one single animal unit. Unlike the tinny farms, the medium-size farms (from 2-5 ha) which are considered "family farms", are relatively close to AE farming, they have the capacity to support the household food sovereignty and maintain crop-livestock integration. On the contrary, large-size farms (more than 7 ha) may not be interested in AE farming since they try to maximize profits through agricultural intensification. ***Third,*** the context of the new lands is poor in terms of agroecology content. The larger part of these lands, covering more than 1 million ha, is newly reclaimed and cultivated in the desert with sandy soil that is poor in organic matter, thus need more chemical fertilizers to compensate. In addition, the cropping pattern in this zone is dominated by horticultural crops with little field crops which lessen the opportunity for crop-livestock integration. Fourth, many of the policies that are actually implemented represent obstacles to agroecology. These include: providing irrigation water free of charge which lead to overuse of water, subsidizing nitrogenous fertilizers, lacking R&D and advisory services, and week enforcement of land tenure governance. ***Fourth,*** both quality and access to land and water resources are deteriorating overtime
6. Several AE-practices are adopted by different categories of farmers with different levels. If ranked based on the degree of "agroecological capacity", medium farmers who could be considered "family farms", in the Old land areas would be ranked first, followed by small, tinny, and tenant farmers in the second place, and large farmers in the Old land in the third place Four categories of farmers/investors would occupy the next four places; those are: medium farmers, small farmers, large farmers exporting, and large farmers not exporting.
7. In terms of agroecology perception, only researchers and representatives of public authorities know about agroecology, whereas representatives of farmers and agricultural professions organizations do not know about it. In addition, some NGOs are connected with international donors in agricultural development activities, and their representatives 'responses indicated a relatively sufficient knowledge about agroecology. Weakness of agroecology perception could be explained by the lack of information disseminated on agroecology, ineffectiveness of cooperatives, low priority of agroecology in the national research agenda. Representatives for public authorities are not convinced of the capacity of

agroecology in achieving national food security goals as an alternative for agricultural intensification approach.

Conditions needed for the development of agroecology in Egypt can be summarized as follows:

- ***Unlocking the ideological barriers to political recognition of AE***

The negative perception of policy makers towards agroecology is in fact the principal obstacle to its development. May be to change this position, they need strong evidence that agroecology can respond efficiently to their policy concerns particularly in terms of the national food security which they believe that it should be dealt with through agricultural intensification approach. Taking into consideration the fact that transition to agroecology is rather lengthy process and involve some risks from the point of view of farmers, intensive research program has to be carried out to provide answers for all questions raised by both policy makers and farmers of different types.

- ***Enabling institutional arrangements:***

  Development of agroecological sustainability requires designing an adequate strategy for managing a transition means that are adapted to local conditions. The transition process will have to meet certain conditions, including: considering collective actions, thus also ensuring coordination between different actors particularly in the fields of agricultural value chains, rural food industries, recycling; combining the ecosystems, traditional knowledge and know-how, with the best use of modern agroecological science.

- **Agroecology-related research**:

  To harness the potential of agroecology as an alternative to sustainable development, agroecology should be put as a priority in the national scientific agenda for agriculture. Key aspects of agro-ecological research include participatory knowledge development, on-farm studies, and holistic research approaches that consider social and economic aspects. Agroecology-related research agenda should include a comprehensive diagnosis of sustainability challenges and conditions specific to the particular given context. The diagnosis must take into account; identifying all assets (natural, social, human, physical and financial) locally available, as well as all human and environmental constraints and the ways through which those elements interact with each other; defining expected benefits in the short, medium and long term; moving beyond the level of the farming system;

- ***Enabling public policy environment:***

  Enabling policy environment and economic support to promote sustainable agriculture and food systems through innovative, integrative and measurable approaches, including: i) innovation in agricultural and rural policies, institutions and partnerships, as well as in the production, processing, marketing and consumption of nutritious foods, leading to sustainability and equity throughout the entire food and agricultural system, ii) Strengthening agri- environmental policy measures, assure policy coherence to allow a conducive policy context informed by science, iii) Supporting the self-organization of farmers, including women farmers and food producers, and ensure that they participate in decision-making and the shaping of policies, iv) Taking measures to increase the capacity of recycling farm residues and reducing the competition between food,

feed, and fuel on arable crop land, v) Strengthening and developing new local marketing structures and marketing support measures for the value chains of agroecological products, vi) taking specific actions for empowering women; and improving agricultural and food governance, vii) Ultimately, strong action will be needed for dismantling the monopolistic power in the agricultural markets and format agricultural and food systems to serve the interests of the producers and consumers, viii) Design and implement a framework for coordinated action and cooperation among concerned actors. This includes: i) collaboration in a comprehensive manner with all stakeholders – government, producer and consumer organizations, non-governmental organizations, civil society, researchers and the private sector, ii) Ensure cooperation and coordination between international agencies and donors, in particular on climate change, biodiversity, food security, nutrition, ecosystem restoration and family farming, among others.

- **Technical support services**:

  To disseminate agroecological systems at sector-wide scale, there is a strong need to extensive technical support taking into consideration the fact that the majority of Egyptian farmers are small and tinny-size holders and about 20 percent of them are non-educated. Further, the existing agricultural extension service is so weak or absent. Strengthening farmers' awareness and knowledge on agroecological systems, and the application of agroecological practices and novel technologies like digitalization as well as scaling up the existing agroecological practices. These activities can be performed through co-operation between agricultural extension agency and agricultural scientific disciplines as well as the private sector. Farmer-led, bottom-up approach adopted through farmer-to-farmer networks could be substantially effective in the development of agroecology through letting the farmers lead the most adequate methodologies for promoting farmers' innovation and horizontal sharing and learning.

6.6. Report Appendixes

6.6.1. Tables annexed to Chapter Six

Table 1: SADS 2030 objectives, national programs and projects and their performance indicators

Specialized Program/Project	Current status	2030
Objective 1: Enhance food security and improve nutrition		
The National Project for the development of pulse and forage crops	- Local bean self-sufficiency: 40 %	86.5%
	- Clover productivity 31.25 ton/fed	50 ton/fed
	- Green forage area: 2.75 million feddan	3.3 million feddan
The National Project for the development of drought-tolerant fruit crops	- Number of palm trees: 15 million palm trees	5 million palm trees
	- Olive productivity (table varieties):3.3 ton/ feddan	5.5 ton/ feddan
	- Olive productivity of oil varieties: 5.0 ton/ feddan	6.5 ton/ feddan
	- Pomegranate productivity: 8.4 ton/ feddan	11 ton/ feddan
Objective 2: Promote sustainable agriculture		
The national Project to modernize and rationalize the use of irrigation water in agriculture	- On-farm irrigation efficiency: 50 %	100% (2.2 million feddan)
	- Increase the land productivity by	30 %
	- Irrigation water savings	1 billion
	- Increase the mean income for small farmers by	20 %
	- Agriculture intensification rates: 177 %	195 %
Objective 3: Eradicate poverty in rural areas, improve income and living standard		
The National Program for territorial development, economic and social recovery	- Rehabilitation and activation of the role of agricultural cooperatives. - Develop productive and specialized rural areas. - Develop human resources (especially the rural youth and women). - Integrated management of agricultural by-products in rural areas. - Encourage collective and collaborative marketing for farmers, especially smallholders. - Produce agricultural products as per contracting agriculture system with small farmers. - Provide farmers with effective extension systems that ensure a smooth sharing of information and knowledge along the value chain. - Diversify rural economic activity to create new job opportunities to reduce unemployment among rural women and youth. - Increase the income of rural households by increasing the added value and promoting the value chains of agricultural products to reduce poverty. - Develop specialized rural areas in various production and services activities according to the type of available resources. - Modernize and rehabilitate rural agriculture training centers. - Maximize the economic benefits of the huge amounts of agricultural and processing by-products to improve farmers' income. - Produce non-conventional feeds from agro-industrial by-products to reduce feeding cost. - Improve the environment and health in the rural areas. - Create new non-conventional job opportunities for youth in rural areas.	
Objective 4: Adapt to the climate change and mitigate its impacts		
The National Project to modernize on-farm irrigation and rationalize the use of irrigation water in agriculture	- On-farm irrigation efficiency: 50 %	100% (2.2 million feddan)
	- Increase the land productivity by	30 %
	- Irrigation water savings	1 billion
	- Increase the average income for small farmers by	20 %
	- Agriculture intensification rates: 177 %	195 %

Develop more drought-tolerant, high temperature-tolerant and disease-resistant wheat and barley varieties	16 new varieties (wheat) 16 new varieties (barley)	5 new varieties (wheat) 4 new varieties (barley)
Develop new rice varieties and hybrids of less water requirements	12 varieties	5 new varieties and hybrids
Produce hybrids to save irrigation water used in Corn production	5 varieties	5 new varieties and hybrids
Produce hybrids of Sorghum crop that are more-tolerant to adverse environmental conditions	5 varieties	3 new hybrids
Develop early- maturing, pest and disease- resistant varieties of local Bean crop	10 varieties	3 new varieties
Develop heat and drought-tolerant and early mature varieties of the Egyptian cotton crop in Upper Egypt	1 variety	1 new varieties
Objective 5: Increase the competitiveness of agricultural products		
The National Project to reduce food losses of agricultural products	- Reduce the losses of agricultural products by 50% by 2030.	
Objective 6: Creation of job opportunities for employment, especially for the youth and women		
The National Project to modernize on-farm irrigation and rationalize the use of irrigation water in agriculture	- On-farm irrigation efficiency: 50 %	100% (2.2 million feddan)
	- Increase the land productivity by	30 %
	- Irrigation water savings	1 billion
	- Increase the average income for small farmers by	20 %
	- Agriculture intensification rates: 177 %	195 %
The National Project to reduce food losses of agricultural products	Reduce food losses of agricultural products by 50% by 2030	
The National Program for territorial development, economic and social recovery	- Rehabilitation and activation of the role of agricultural cooperatives. - Develop specialized and productive rural areas. - Develop human resources (especially the rural youth and women). - The integrated management of agricultural by-products in rural areas. - Encourage collective and collaborative marketing for farmers, especially smallholders. - Produce agricultural products as per contracting farming system with small farmers. - Provide farmers with effective extension systems that ensure a smooth sharing of information and knowledge along the value chain. - Diversify rural economic activity to create new job opportunities to reduce unemployment among rural women and youth. - Increase the income of rural households by increasing the added value of agricultural products to reduce poverty. - Develop specialized rural areas in various production and services activities according to the type of available resources. - Develop and rehabilitate rural agriculture training centers. - Maximize the economic benefits of the huge amounts of agricultural production and processing by-products to improve farmers' income. - Produce non-conventional feeds from agro-industrial by-products to reduce feeding cost. - Improve the environment and health in the rural areas. - Create new non-conventional job opportunities for youth in rural areas.	
Cross-cutting programs and projects for (serving) all objectives		
The National project to support and modernize the role of information technology and communication in the agriculture development	- Establish and upgrade the information infrastructure of the Ministry of Agriculture. - Develop and raise management and operation efficiency of agricultural information technology and communication. - Provide timely services and information to farmers, to improve farmers' access to markets and increase the efficiency of agriculture activities. - Expand the use of digital agriculture.	

The National Project for institutional reforms	- Restructuring of the Ministry of Agriculture to raise the performance efficiency. - Eliminate any conflict and duplication of roles among various directorates and units within institutions. - Provide appropriate administrative and organizational conditions to achieve the strategic objectives of the agricultural sector.
The National Project for agricultural policy reforms	- Reform legislative frameworks to ensure the effectiveness and coherence of development programs and projects. - Achieve coherence and cohesion between the national objectives and the private sector investment in agricultural resources. - Support small farmer's capacity and reduce rural poverty. - Reduce sharp price volatility of agriculture products and production inputs.
The National Project to support agriculture research, technology transfer and agricultural extension	- Coordination and integration between agricultural research institutions in the implementation of the national research plan to address existing and future challenges facing the agricultural sector. - The use of latest scientific achievements in research programs to achieve horizontal and vertical expansion in the production of strategic food crops, locally, and maximize the benefits of land and water units. - Update research programs to develop highly yielding adaptable to adverse environmental conditions, and disease- and pest- resistant new varieties. - Modernize and maintain the infrastructure of agriculture scientific research institutions. - Human development of research staff , especially young researchers and assistant technicians, and expose them to international expertise. - Sustainable linkages between the agriculture scientific research system, agricultural extension and technology transfer, and the industrial institutions. - Enhance and sustain cooperation with regional and international research institutions. - Develop modern and emerging technologies and adapt them to the local consitions of the agricultural sector. - Provide an enabling environment conducive to scientific research and innovation. - Produce new high-yielding and good quality varieties of strategic crops based on high science quality to achieve sustainable agriculture development. - Reduce the food gap between local production and consumption, and achieve food security in strategic crops.

Source: Compiled from: MALR (2019). The SADS 2030

Table 2: The Relationship between the Sustainable Agriculture Development objectives, the updated vision of Egypt, the Agroecology objectives and relevant UN and national indicators.

SDGs	Indicator	Unit	Current Status	Notes	Target 2030
SDG 1: End poverty of all forms everywhere	Percentage of subsidy granted to the agricultural sector out of total government subsidy	%	2.40%	(2016-2017)	5%
	percentage of loans and financial instruments offered to small farmers to total expenditure on agricultural sector	%	53%	(2016-2017)	55%
	Total investments in the agricultural sector	(Billion EGP)	21.9	(2016-2017)	40
	Number of new job opportunities provided by the agricultural expansion projects	(million job opportunities)	0.665	(2016-2017)	1.93
	Mean labor income in the agricultural sector	(EGP/ day)	70	(2016-2017)	120
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Total Factor Productivity	%	1.30%	(2011-2016)	2.56%
	Agricultural value added growth rate	%	3.70%	(2019-2020)	4.50%
	Agriculture contribute to the GDP	%	12%	(2019-2020)	15%

	Increase in agricultural cultivated area	(million feddan)	1	(2019-2020)	1.5
	Wheat self-sufficiency ratio	%	44%	(2019-2020)	67%
	Maize self-sufficiency ratio	%	56%	(2019-2020)	56%
	Oil self-sufficiency ratio	%	8%	(2019-2020)	17%
	Fish self-sufficiency ratio	%	82%	(2019-2020)	100%
	Milk self-sufficiency ratio	%	100%	(2019-2020)	120%
	Red meat self-sufficiency ratio	%	52.25%	(2019-2020)	64.70%
	Poultry self-sufficiency ratio	%	96%	(2019-2020)	137.50%
	Number of agricultural extensionists	per 1000 farmers	0.7	With the application of e-extension	2
	Public expenditure on the agriculture sector as a percentage of the GDP	%	0.37%	(2016-2017)	0.45%
	Subsidy granted to the agriculture sector out of the total subsidies	%	2.40%	(2016-2017)	5%
	Expenditure on research and development in the agriculture sector	%	0.07%	(2016-2017)	1%
	Overall investments in the agriculture sector	(billion EGP)	21.9	(2016-2017)	40
SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent	Gini coefficient		31.5	(2017)	25
	Average GDP growth rate in the agriculture sector	%	3.20%		4.50%
Promote sustainable agriculture	The ratio of water used in the agriculture sector to the total available water resources	%	85%	(2016-2017)	80%
	The ratio of cultivated lands with organic crops to the total cultivated lands	%	3%	(2016-2017)	6.46%
	The ratio of reclaimed lands adopting sustainable agriculture methods to the total formally and recently reclaimed lands	%	35%	(2016-2017)	71%
	The ratio of the use of organic fertilizers	%	16%	(2016-2017)	25%
	The ratio of the use of fertilizers and chemical pesticides to the total fetilizers used in the agriculture sector	%	84%	(2016-2017)	75%
	The ratio of lands irrigated using the advanced and modern irrigation methods	%	16.50%	(2016-2017)	31.70%
SDG 6: Ensure availability and sustainable management of water and sanitation for all	The ratio of the rural population with access to drinking water	%	96.70%	(2016-2017)	100%
	The ratio of the rural population with access to sanitation services	%	37%	(2016-2017)	50%
SDG 13: Take urgent action to combat climate change and its impacts	GHG emission rate from agriculture sector	%	1.20%	(2016-2017)	1%
	The ratio of lost agricultural lands annually due to encroachments, deterioration and desertification	%	0.40%	(2016-2017)	0.01%

	Ratio of loans and financial instruments offered to small farmers (small and medium holders) to the total expenditure on agriculture sector	%	53%	(2016-2017)	55%
	Number of the new job opportunities provided in the agricultural expansion projects	(million job opportunities)	0.665	(2016-2017)	1.93
	Average labor income in the agriculture sector	(EGP/ day)	50	(2016-2017)	100
	Agriculture GDP growth rate	%	3.70%	(2019-2020)	4.50%
	The ratio of the rural population with access to drinking water	%	96.70%	(2016-2017)	100%
	The ratio of the rural population with access to sanitation services	%	37%	(2016-2017)	50%
	Agricultural waste recycling and its conversion to compost and other uses	%	10%	(2016-2017)	30%
	The ratio of solar energy used in the agriculture sector to the total energy used	%	1.50%	(2016-2017)	10%
	The rainwater harvesting capacity	(million m3)	3.2	--	8.1
	GHG emission rate from agriculture sector	%	1.20%	--	1%
	The ratio of agriculture exports to total exports	%	24%	--	30%
	Increase in the exports value	(billion USD)	5	(2016-2017)	10
	The ratio of imported food goods to the total imports	%	7.80%	(2016-2017)	6%
	The agriculture labor to the overall labor in Egypt	%	27%	(2019-2020)	30%
	Rural unemployment (unemployment rate for 15-24 age bracket for 2017)	(especially for the youth)	30%	(2019)	15%
	Number of the new job opportunities provided by the agricultural expansion projects	(million job opportunities)	0.665	--	1.93
	Gini coefficient		31.5	(2017)	25
	Agriculture GDP growth rate	%	3.20%	--	4.50%

Source: Compiled from: MALR (2019). The SADS 2030

6.6.2. The Strategic Goals and Targets of Egypt's NBSAP

This vision and mission lead to formulate the Strategic Goals and Targets of NBSAP 2030 to be as follows:

Strategic Goal 1: Conserve and manage terrestrial and aquatic biodiversity to ensure sustainable use and equitable benefits to the people

- **T1:** By 2030, PAs network secured and expanded to cover 17% of total terrestrial and inland water and at least 5% of coastal and marine representative areas, especially priority sites of particular importance for biodiversity and key ecological Processes, and Effective management of PAs
- **T2:** By, 2020 develop and implement unified Egyptian methodology for the identification and monitoring of priority of all components of biodiversity according to the international standards to ensure the maintenance or rehabilitation of 50% of our most threatened species focusing on mammals and reptiles to a favorable conservation status
- **T3:** By 2030, National conservation and/ / or rehabilitation programs of the largest part of threatened species and endemic species at risk are developed and implemented with measures to evaluate its implementation
- **T4:** By 2020, all IAS and pathways are identified and prioritized with measures in place to update and verify these pathways, in addition to development of national programs to control and manage IAS.

Strategic Goal 2: Sustainable use of natural resources:

- **T5:** By 2020, Conservation of natural resources through the adoption of ecologically sustainable agricultural management practices, including control of fertilizers and pesticides.
- **T6:** By 2018, apply CBD tools to monitor and control the impact of tourism on biodiversity, in particular in protected areas and vulnerable ecosystems.
- **T7:** By 2020, measures, including waste management plans and law enforcement, are in place to prevent and reduce the impact of pollution and waste on ecosystems, especially on wetlands and coastal and marine areas.
- **T8 a:** By 2025, negative effects of different sectoral policies (land-use planning, transport, energy, uncontrolled urbanization, etc.) on priority elements of biodiversity are minimized, and measures to correct these effects are applied through developing and implementing land use management plans.
- **T8 b:** By 2021 rate of wetland loss is reduced by 50%, water efficiency in farming is improved by 50%, and BMP in development of inland water ecosystems are available to policy makers.
- **T9:** By 2027, promote the implementation of good fishing practices in both Mediterranean Sea and Red Sea, favorable to fish protection and their habitats.

Strategic Goal 3: Access to genetic resources and Benefit sharing (Nagoya protocol, indigenous knowledge and traditions)

- **T10**: By 2020, Effective operational biosafety and ABS mechanism (measures and legislation) in place, in accordance with national laws and relevant international obligations and serving national priorities relating to biodiversity.
- **T11:** By 2020, to promote sustainable hunting and harvesting through adequate planning, restoration and protection of key biological resources.

Strategic Goal 4: Improve our understanding of biological diversity and ecosystem functioning in a changing environment

- **T12:** By 2020, the knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied
- **T13:** By 2030, Research and implement measures and strategies to strengthen local- level biodiversity resilience.
- **T14:** By 2020, enhancing environmental awareness of Egyptians of the importance of biodiversity and ecosystem services through integrating environmental themes into university and school curricula, promoting green media, and supporting youth clubs and eco-industry.

Strategic Goal 5: Prepare for climate change and combat desertification:

- **T15:** By 2020, investigate and monitor all the effects of climate change on biodiversity and ecosystem services.

Strategic Goal 6: Build partnerships and integrate biodiversity into all national development frameworks

- **T16:** By 2018, biodiversity values are promoted and integrated into national planning process and mechanisms to support their incorporation into national accounting and reporting systems to be developed
- **T17:** By 2018, ensure that the national strategy is supported by effective legislation and institutional frameworks to improve its enforcement
- **T18:** By 2017, proper NBSAP and associated resource mobilization are in place, in addition to establishment of the national biodiversity committee to ensure periodic evaluation of NBSAP.

6.6.3. Lists of actors interviewed in Egypt

Table 1: Location and main characteristics of farmers interviewed.

	Region	Region	Main crops
Old land-small			
1	Kafr El Dheikh	0.25	Wheat, maize
2	Fayoum	0.5	Wheat, berseem, maize
3	Beni Sweif	1.0	Wheat, berseem, maize, livestock
Old land-medium			
1	Kafr El Sheikh	1.5	Wheat, berseem, maize,rice,livrstock
2	Fayoum	2.5	Wheat, berseem, maize,rice, livestock
3	Beni-Suif	4.0	Wheat, berseem, maize,rice, livestock
Old land-large			
1	Kafr El Sheikh	7.0	Wheat, berseem, maize,rice, livestock
2	Fayoum	10.0	Wheat, berseem, maize,rice, livestock
3	Beni-Suif	20.0	Wheat, berseem, maize,rice, livestock
New land-small			
1	Esmaelia	0.7	Wheat, vegetables
2	Suiz	1.5	Wheat, vegetables
3	Beheira	2.0	Wheat, berseem, maize, livestock
New land- medium			
1	Esmaelia	3.0	Mango
2	Suiz	4.5	Berseem, maize, vegetables, livestock
3	Beheira	7.0	Olives, fig
New land-large			
	Esmaelia	10.0	Fruits. vegetables
	Suiz	13.0	Fruits. vegetables
	Beheira	200.0	Vegetables for export and local market

Source: Selected by the Author.

Table 2: List of Agricultural Professions Organizations.

	Type of Organization	Region	Activities
Old Land			
1	Cooperative Organization	Beheira Governorate	Supervising agricultural production
2	Cooperative	Kafr El-Sheikh Governorate	Supervising agricultural production
New Land			
1	Cooperative	Wadi ElNatroon	Reclamation and cultivation in desert land
2	Cooperative	Menofya Governorate	Reclamation and cultivation in desert land

Source: Selected by the Author.

Table 3: Researchers in different research institutions.

Faculty of Agriculture		Ministry of Agriculture and Land Reclamation		
	Specialization		Specialization	Institute/center/lab
1	Rural Sociology	1	Climate Change	Central Lab for Climate Change,ARC
2	Agricultural Extension	2	Expert Systems	Institute of Agricultural Extension Research, ARC
3	Agronomy	3	Agronomy	Institute of Field Crops Research, ARC
4	Bacteriology	4	Agricultural Economics	Institute of Agricultural Economics, ARC
5	Soil And Water	5	Soil and Water	Institute of Soil, Water, and Environment, ARC
		6	Development Economics	Institute of National Planning (INP)

Source: Selected by the Author.

Table 4: Non-Governmental Organizations.

	Scope of NGO activity	Work region	Nature of members activity
1	Implementation of agricultural projects	Country-wide: “Grow Initiative”	Wheat producers. 150000 small farmers
2	Production, packing, and export of fruits and vegetables	Beni-Sweif Governorate	Producers of fruits and vegetables

Source: Selected by the Author.

Table 5: List of representatives of public authorities: posts and scope of activities

	Post	Scope of Activity
Ministry of Agriculture and Land Reclamation		
1	Senior Advisor of the MALR	Setting and follow up of agricultural policies
2	Ex Director, Desert Research Center	Desert policies and research
3	Ex Director, Agricultural Research Center (ARC)	Setting and follow up of research policies
4	Director, Agricultural Economics Research Institute (AERI)	Setting and follow up of economic research and agricultural information
5	Director, Center for Contracting Agriculture	Supervising contracting agriculture
Ministry of Water Resources and Irrigation		
1	Secretary General, Arab Water Council, and Ex Minister of Water Resources and Irrigation of Egypt	Setting and follow up of water policies
2	Director, Water Research Council of Academy of Scientific Research and Technology and Ex Vice Minister, MWRI	Setting and follow up of water, climate, food research

Source: Selected by the Author.

Chapter 7

National Report for Mauritania

Cheikh Sidya FALL (GRDR)

Chapter Seven **National Report for Mauritania**

7.1. General Introduction

With an area of 1,030,700 km2, Mauritania is bordered to the west by the Atlantic Ocean, and is surrounded by Senegal, Mali, Algeria and Western Sahara. Mauritania's population in 2021 was 4,271,197 inhabitants, compared to 3,537,368 inhabitants in 2013 and 2,508,159 inhabitants in 2000 (ANSADE). Over the past decade, the population growth rate has fallen slightly to 2.702% from 2.77% over the period 2000-2013. The country has a young population with 40.2% of the population under the age of 15. In addition to demographic change, Mauritania's rate of urbanization is constantly increasing. This reached 55.3% of the total population in 2020 compared to 48.3% in 2013 with an acceleration of sedentarization. (MEAPS, 2022).

The last two Permanent Surveys on Household Living Conditions (EPCV), conducted in 2014 and 2019-2020, show that the poverty prevalence rate fell from 30.9% to 28.2% (a decrease of 2.7 points). The latter remains a rural problem, with an incidence of 41.2% in rural areas, compared to 14.4% in urban areas. The rural community's contribution to extreme poverty is more than 80 per cent, regardless of the poverty measure chosen. This still worrying level of poverty, particularly in rural areas, is a potential danger to social cohesion and peace. According to the 2016 Human Development Report, Mauritania, with a Human Development Index (HDI) of 0.513, ranks 157th out of 185 countries.

In this context, poverty has a particular impact on women and young people. It places young people on the trajectory of irregular migration and that of radicalisation and violent extremism. Despite this concern for relative inequality, accompanied by the risks mentioned, there is a positive trend. Indeed, Mauritania's Human Development Index in 2019 rose to 0.546 from 0.397 in 1990 (an increase of 37.5% - UNDP) and the human inequality coefficient to 31.8% in 2019 from 34% in 2014 (National Agency for Statistics and Demographic and Economic Analysis,ANSADE).

In terms of economic integration, the level of unemployment seems to be persistent, recording a rate of 12.2% in 2019 (ANSADE) compared to 11.8% in 2017 (Common Country Assessment 2020). Unemployment in 2019 affected women more than men, with rates of 17.3% and 9.3% respectively. It is also noted that there is a predominance of men in the labour market who are better integrated into the labour market. This predominance can be explained mainly by social and cultural reasons.

In addition, youth unemployment also affects girls more than boys regardless of age: 25.6% (26.3% for 14-19 year olds, 37.3% for 20-24 year olds, etc.) compared to 14.5% (18.9% for 14-19 year olds and 22.6% for 20-24 year olds). This situation demonstrates the need to take into account the gender and youth dimension in the country's development strategies in order to ensure social equity and reduce inequalities.

Historically, over the last thirty years, Mauritania has recorded an Average Annual Growth Rate (CAGR) of around 5%. Four main periods of growth have been identified:

- 1990-1999: CAGR 2.5%
- 2000-2005: CAGR 6%
- 2006-2015: CAGR 3.3%
- 2016-2019: CAGR 5.4%

Figure 16: Evolution of the CAGR from 1990 to 2020 In Mauritania.

Source: AP2 AGSPS, 2021-2025

Including the year 2020 in the calculations, the growth of which has been strongly impacted by the pandemic, the average growth level over the period 2016-2020 should be around 3.8% on average (Second action plan (2021-2025) of the Accelerated Growth and Shared Prosperity Strategy, AP2-AGSPS).

An analysis of the distribution of Gross Domestic Product (GDP) also shows that most of the value added created has been achieved by the tertiary sector. At the primary level, it is dominated by livestock farming, while the secondary sector is dominated by extractive industries. In addition, more than a third of the value added created by the tertiary sector (excluding administration and taxes) is generated by commercial activities.

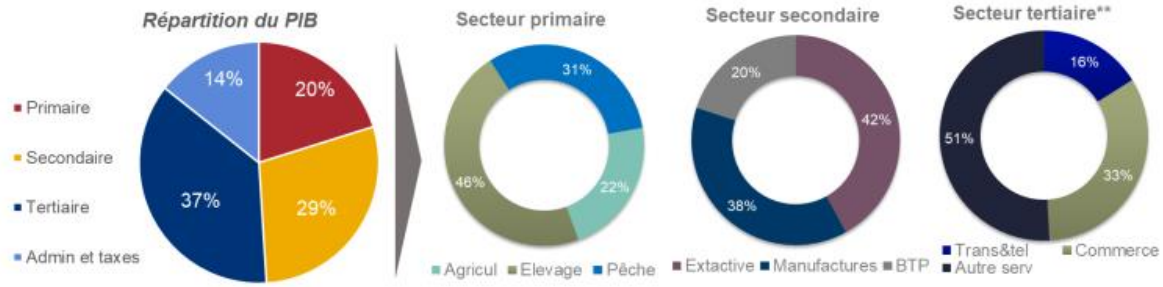


Figure 17: Breakdown of the GDP in 2020 in Mauritania.

Source: AP2 AGSPS, 2021-2025

In terms of foreign trade, Mauritania's trade balance has historically been in deficit before returning to a trade surplus in 2020. In this context, Mauritanian exports are concentrated around raw materials, particularly iron ores (a third of exports in 2020), gold (a quarter of exports in 2020) and to a lesser extent other minerals and seafood products (Ministry of Finance, 2023). As far as imports are concerned, they are quite diversified and come from all sectors.

In terms of outlook, the sectoral analyses, carried out as part of the preparation of the AP2 AGSPS, confirm the existence of significant growth potential in certain sectors of the Mauritanian economy. The transformation of this potential into real growth would depend mainly on two parameters: the ability to effectively implement the AP2 AGSPS as well as the various sectoral strategies, and the effective will to initiate a structural transformation of the Mauritanian economy.

7.2. Background

7.2.1. Main indicators for agriculture and livestock in Mauritania

7.2.1.1. Key indicators for agriculture

Despite the constraints of the arid Sahelo-Saharan desert climate, characterized by galloping desertification, punctuated by repeated droughts and exacerbated by the country's vulnerability to climate change, Mauritania has natural assets that encourage public and private investment in the agricultural sector. This is an agricultural potential of more than 513,000 hectares (RSDS, 2013) which offers significant opportunities for intensification, diversification and improvement of competitiveness and challenges the various actors as to their ability to design and establish sustainable management systems for the consolidation of the achievements in this context.

The agricultural sector employs a large number of inhabitants and its contribution to GDP is estimated at 4% in 2020 and provides income to nearly 54.98% of the population (Source: AP2 AGSPS). It is piloted on the basis of the National Agricultural Development Plan (2016 – 2025). Agricultural production is not able to adequately cover the food needs of the population. Low yields of major crops, especially cereals, as well as inefficient food storage, processing and distribution systems limit the availability of agricultural products and the regularity of supplies. Producers, especially women and youth, as well as other actors involved in the production, processing and marketing process, face challenges along the value chain of the main agricultural value chains. This situation justifies the adoption of a value chain approach in the implementation of new interventions in the agricultural sector, not only to increase production and develop the potential of the different production systems, but also to improve the conservation, processing and marketing of agricultural products.

The processing of paddy into white rice and wheat is carried out by small-scale private hullers, rice mills and village-level producer organizations. There are currently 16 private rice mills and a large number of small hullers. Processing of traditional cereals is carried out manually by rural women or by grain mills run by small private operators and producer organizations at the village level.

For example, the agricultural sector could almost double its GDP by expanding current arable land by 1% and improving productivity per hectare by the same percentage. These avenues for improvement do not seem to be unattainable given the potential of unexploited areas and the low crop yields relative to certain countries with a similar level of development to Mauritania.

The main challenge for agriculture is therefore to take advantage of the great potential of agricultural land and water potential for the diversification and intensification of crops through public and private investments.

7.2.1.2. The main indicators relating to livestock

The livestock sector is at the heart of the subsistence economy, even if the nomadic lifestyle is declining, especially in the south of the country (5% today compared to 60% in the 1960s). The livestock sector is one of the main pillars of Mauritania's economy and is driven by the National Livestock Development Plan (NLDP 2018). Its contribution to the national economy was, on average, 10.9% of GDP over the period 2016-2020 (Source: AP2-AGSPS). The average annual real growth rate was 4.2% over the same period. It provides income to nearly 60% of the population (Source: NLDP 2018). Livestock farming is the second largest employment

sector because it employs nearly 16% of the working population (ONS, 2013), including shepherds, water drawers, collectors, butchers, milk processors and sellers, leather craftsmen, jobs related to urban transport by donkey cart, etc.

In addition to the formation of national value added, the livestock sector also contributes to the distribution and distribution of the resources and income generated. Producers' incomes would thus account for nearly 80% of the sector's value added at the producer stage, while income-generating activities upstream or downstream of production would generate 12% of the sector's value added.

Over the past 3 decades, the livestock sector has been marked by profound changes caused mainly by droughts causing a sharp decrease in livestock numbers and socio-economic disruptions within pastoral communities. The sector's contribution is subject to uncertainties related to its still very traditional management method with a low use of market inputs and dependent on fodder from natural pastures.

In the majority of cases, livestock farming is extensive, but in recent years there has been a shift towards other pastoral systems. It is practiced mainly in an area with a Sahelian climate that covers the entire south of the country between the 15th and 18th parallel north. The distribution of the herd depends on the species. In the days when nomadism was important, there was a clearer separation between the livestock subsector and the agriculture subsector. However, the effects of drought and the sedentarization of nomads have meant that animals are found in all agricultural production systems. As a result, agreements between farmers and herders are more frequent.

The main animal production sectors are: the live cattle and red meat sector, the milk and dairy products sector, the leather and skin sector and the very recent poultry sector which is beginning to develop on Mauritanian territory.

The main challenge for the livestock sector is to build accelerated and diversified growth in the fight against poverty on this great potential.

7.2.2. The state of natural resources and agrarian structures

Mauritania is characterized by an arid desert climate and limited availability of water resources, strongly influencing agricultural production systems.

7.2.2.1. State of Natural Resources

- **Soils and land**

As Mauritania is a predominantly Saharan country, fertile and exploitable land is quite limited. Raw, young, skeletal, poorly differentiated mineral soils developed on ergs and rocks covering about 80% of the country. The country has a significant agricultural land potential of 513,000 ha (0.44% of the total area of the country), divided into four agro-ecological zones: (i) the arid zone (16,000 ha, or 3%), (ii) the Sahelian zone (310,000 ha, or 61%), (iii) the Senegal River Valley zone (175,000 ha, (iv) the maritime zone (12,000 ha, i.e. 2%), which is currently very underexploited and can be developed in the context of food security.

According to data provided by the Ministry of Agriculture through its Regional Delegations in March 2015, the total area developed is 63,070 ha, of which 73% are functional perimeters and 27% non-functional and/or

abandoned. In addition to this area, 4,600 ha are under rehabilitation. Among the reasons for this abandonment of developed areas are: (i) summary development with technical characteristics that do not allow them to be physically viable and economically sustainable; (ii) soil degradation (salinity, invasion of canals by typha) and, (iii) the weakness of producers' development capacities, leading to low cultivation intensity and still low average yields.

- **Surface and groundwater**

Surface water is mainly made up of the Senegal River and its tributaries. Only 0.1 km³ out of 11.1 km3/year of renewable surface water (MHS, 2012) is generated in the interior of the country and the 405 reservoirs (dams and dikes with a total capacity of 0.9 km³, including 0.5 km³ for the FoumGleita dam) (MESD, 2010) are the main possibility of mobilizing temporary surface water. The country has significant groundwater resources, although it is characterized by large geographical disparities, and some of the most important aquifers are located in desert areas far from urban centres. Renewable groundwater is estimated at 0.3 km³/year (MHS, 2012);

- **Biodiversity**

The plant biodiversity consists of 72 woody species and 166 herbaceous species. The last and only inventories date back to the 1980s, but wild flora has experienced the same trend of impoverishment of its diversity and density. 22 endangered native plant species have been fully protected by law, but there is a gradual disappearance of wild plants important for food, the replacement of endemic wild species by cultivated plants. In addition, the disappearance of vegetation gives rise to sand movements and badlands and the process of degradation of ecosystems continues. If the current trends of environmental degradation, and therefore of ecosystems, are maintained, the potential for enhancing the country's plant and faunal biological diversity will be lost and their rehabilitation will be long and difficult (NBSAP, 2011-2020).

As far as terrestrial fauna is concerned, the crocodile suchus is present in the lower delta and continental wetlands such as Bougary, Tamchakett, Matmata, etc. The manatee has almost disappeared from the river and the hippopotamus is threatened with extinction. Generally speaking, the presence of wildlife is limited to a few remote places.

7.2.2.2. Agriculture

7.2.2.2.1. Agro-ecological zones

All crop production is divided into four main agroecological production zones:

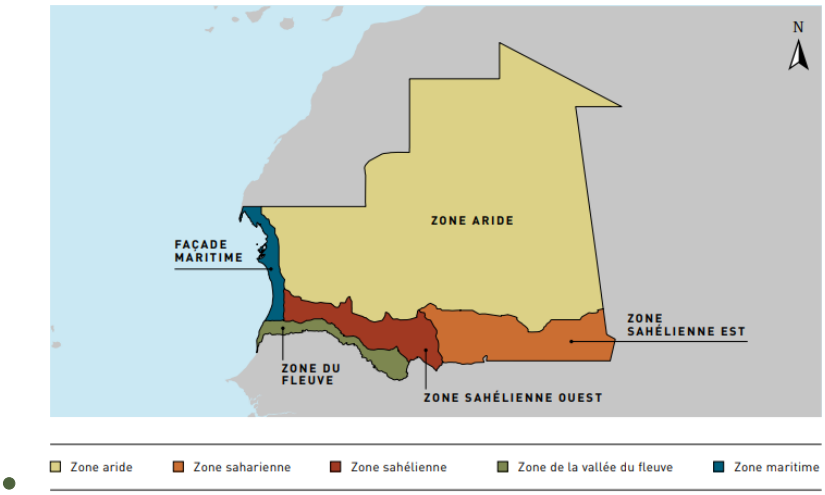


Figure 18: Agro-ecological zones of Mauritania.

Source: RSDS 2013-2025

There are four agro-ecological zones with specific natural and productive potential: (i) the arid zone, (ii) the Sahelian zone, (iii) the Senegal River valley zone and (iv) the maritime zone.

- **The arid zone**, which covers 80% of the territory, includes the wilayas of Tiris Zemour, Adrar, Tagant, and Inchiri and the 3 Moughataa in the north of Assaba and the two Hodhs where the plant population is almost non-existent due to the very high temperatures, the dryness of the air and the very low rainfall. The predominant production system is oasis-type characterized by the cultivation of date palm and associated irrigated crops (cereals, alfalfa, vegetables and fruits). Livestock and rainfed crops occupy secondary places.
- **The Sahelian zones** (East and West) include the 3 wilayas of south-eastern Mauritania, namely Assaba, the two Hodhs (with the exception of the 3 Moughataa included in the arid zone), the Moughataa of the North of Brakna, Gorgol, Trarza and Ould Yengé in Guidimakha. The existence of a summer rainy season, which alternates with a dry winter season, allows the production of rainfed crops. In the eastern part, livestock farming is predominant compared to rainfed crops of traditional cereals (sorghum, millet, maize). However, the western and southern part is characterized by the cultivation of traditional cereals behind dams, dikes and at the level of the lowlands, particularly in Assaba (in Affolé), in Brakna (Magta Lahjar and Aleg) and in the Moughataa of M'Bout and Monguel in Gorgol. In these areas, livestock farming is of the transhumant type.
- **The Senegal River Valley area**, although it covers only 2% of the total area of the country, is the area that has water resources and vegetation allowing the development of agro-sylvo-pastoral activities. In this area, the predominant production system is agriculture in its various forms, led by the irrigated cropping system, followed by the natural or controlled flood recession system of the walo, and that of rainfed crops. Livestock farming is sedentary, semi-intensive with a short transhumance during the growing season. The area covers the south of the 4 wilayas of the river valley (Trarza, Brakna, Gorgol, Guidimakha) where anthropogenic and animal pressures on

resources are increasingly accentuated and generate processes of degradation of the natural environment already subject to the effects of drought.

- **The maritime zone** covers a narrow 50 km wide coastal strip that stretches from Nouadhibou to the mouth of the Senegal River for a total area of 25,000 km². The significant fishing potential of the coastline makes it a highly coveted area for foreign industrial fishermen, while small-scale fishing remains limited and mainly benefits local populations. Nevertheless, there is an opportunity for the development of horticulture in this area. Urban livestock farming is being developed in peri-urban areas.

In these ecological zones, there are also wetlands that serve as transit areas for migratory birds. The main wetlands of the country are: (i) the Senegal River, (ii) the R'kiz Lake, (iii) the Aleg Lake, (iv) the Male Lake, (v) the Tamourt N'nâj, (vi) the Banc d'Arguin National Park, (vii) the Diawling National Park, (viii) the Kankossa pond, (ix) the Vengé area, and (x) the Mahmouda area.

7.2.2.2.2. Production Systems

The five main production systems, dependent on agro-ecological zones, are: (i) the extensive rainfed cropping system in sandy or "dieri" areas, (ii) the cropping system behind dams and lowlands, (iii) natural or controlled flood recession systems, (iv) the oasis system and (v) irrigated agriculture with total water control.

Table 27: Production Systems in Mauritania

Production System	Estimated usable agricultural area		Crops	Agro-ecological zone
	Ha	%		
Extensive rainfed cropping system in sandy or "dieri" areas	250 000	49	Sorghum, millet, maize, vegetables	Sahelian zone
Cropping system behind dams and lowlands »	60 000	12	Sorghum, maize, vegetables	Sahelian zone
Natural or controlled flood recession system of the Walo	40 000	8	Sorghum, maize, vegetables	Senegal River Valley Area
Oasian System	16 000	3	Date palm, vegetables, fruits, alfalfa	Arid zone
Irrigated agriculture with total water control	135 000	26	Rice, maize, sorghum, vegetables, fruits	Senegal River Valley Area
	12 000	2	Vegetables & Fruits	Sea Area
Total	**513 000**	**100**		

***Source*: RSDS 2013-2025**

- **The extensive rainfed cropping system in sandy areas or "diéri** " **-** The crops grown at the dieri level are sorghum, millet and maize with other associated crops (cowpeas, watermelons, squash, guinea sorrel, etc.). The cultivated areas vary considerably according to rainfall: from

30,000 ha to 264,000 ha over the period 1983-2012. The average area farmed per household depends on the management of land in the area. In Guidimakha, the area per household is 1.25 to 3 ha for the wealthy1 and land is traditionally inherited through inheritance. In Gorgol, this land is considered community property and therefore accessible to all. Sowing is done during the first rains in June/July and harvest takes place in October for early-maturing crops - or in December for late-maturing sorghum.

- **The cropping system behind dams and lowlands –** This type of farming is developed on an area that can vary from one year to the next from 14,000 ha to 60,000 ha where sorghum, maize, wheat and vegetables are grown. Sown area and production vary according to rainfall, maintenance of infrastructure and the extent of losses due to pests (including sesamia) that sometimes attack maize and sorghum crops. Cultivation is practiced from the first decade of October (sowing time) until the end of February (harvest time).
- **The Walo natural or controlled flood recession cropping system -** Sorghum and maize are grown in the alluvial plain of the Senegal River and its tributaries and tributaries, taking advantage of natural flooding (natural recession) or controlled flooding (controlled flood recession). Currently, this cropping system is practiced on about 40,000 hectares (cultivated areas fluctuated over the period 1986-2007 between a minimum of 6,905 ha in 2002 and a maximum of 40,130 ha in 1995/96). About 50% of this cropping system is determined by the Manantali dam, from which water is released to reinforce the natural flood. The inflows of this natural flood remain dependent on unregulated tributaries such as the Falémé and the Bakoye. The regulation, which takes place through the Manantali hydroelectric dam, limits the amplitude of floods and flooded areas. Crop losses due to borers discourage the practice of cereal cultivation, even when water is available. Sowing usually begins in the first decade of September and harvests are carried out at the end of March.
- **The oasis system -** This is the production system present in the 352 oases inventoried in the wilayas of Adrar, Tagant, Assaba and the two Hodhs in which 26,836 farms operate (source: provisional report on the "Census of date palms, November 2012 - PDDO and DPCSE/MDR) on an area of 19,687 ha. Agriculture in the oases is largely based on date palm, which remains an important crop both economically and culturally, and is also associated with market gardening. Oasis production (mainly dates) is characterized by a very low yield. Valorisation and marketing are limited by the isolation of these production areas.
- **Irrigated agriculture with total control of water –** This type of agriculture is practiced mainly in the Senegal River valley and concerns: (i) rice, the main crop, in winter, (July-October), (ii) vegetables, maize and sorghum and wheat, in the cold off-season (November-February) and (iii) to a lesser extent rice in the hot off-season from 25 February.

7.2.2.3. Breeding

7.2.2.3.1. Agro-ecological zones

The pastoral agro-ecological zones in the country are as follows:

- **The Sahel-East zone** is the most important breeding area with a cattle herd constituting 64% of the population, sheep and goats reaching 49% of the population and finally camels 40% of the population;
- **The Sahel-West zone** is the second largest livestock farming area in the country, accounting for 33% of the cattle herd, 44% of the sheep and goat herd and 22% of the camel herd;
- **The arid zone** is the least important breeding area, accounting for 3% of the cattle herd, 7% of the sheep and goat herd and 38% of the camel herd.

The dispersal of livestock species across agro-ecological zones means that the cattle herd is mainly on the part between the 150 mm isohyet and the southern border of the country. The camel herd is nomadic for the most part north of the 400 mm isohyet, with the highest densities on the coasts where there are salt pastures very popular with the dromedary. Finally, the sheep and goat herd is scattered throughout the country, with high densities in the south and southeast.

7.2.2.3.2. Pastoral systems

As with agro-ecological zones and cropping systems, there is a specialization of livestock systems. Mauritania has the following main pastoral systems:

- **Nomadic pastoral systems:** The main animals in this system are camels and goats. It is characterized by high mobility. Herd movements are dependent on the availability of natural pastures and water sources. During the wintering season (mid-July and September), the herds move as far north as possible, generally in their own land. However, during the cold dry season (October and February) the nomads slowly advance southwards. During the hot dry season (March to mid-July), they usually settle near water sources.
- **Transhumant pastoral and agropastoral systems:** transhumant livestock farming is characterized by the fact that the herd or fraction of a herd used to transhume for seven to eight months. Pastoral mobility can take herders out of the country (Mali or Senegal) and return to a home base where the herd owner's family resides. The flocks are sometimes herded by family shepherds, but they are often entrusted to salaried shepherds5 who are often accompanied by at least one family member in charge of management. The main animals in this system are cattle, sheep and sometimes goats and camels. There has been a significant reduction in this type of herd mobility. The duration of transhumance is greatly shortened and limited to two or three months during the lean season between May and July. The diet of transhumant animals is almost exclusively based on natural rangelands. However, supplementary feeding is often provided during the lean season and especially for sick or weakened animals.
- **Agropastoral systems with sedentary livestock associated with agriculture:** the animals concerned by these systems are cattle and small ruminants. The maturation is fixed throughout the year on the same terroir. The farmer is responsible for the night guarding of his animals. During the winter, the animals are left to roam throughout the day or led by a shepherd to the pastures on the outskirts of the villages. This type of livestock farming is practiced in the south (valley area and particularly in the Gorgol and Guidimackha regions). During the winter, the

animals are content with natural pastures and in the dry season, they are fed with crop residues (especially stubble left over from the fields) in addition to natural pastures;

- **Extensive urban systems:** created in response to the effects of drought and as a corollary to urbanization, these systems are specialized in goat farming and sheep fattening. Their objectives are the production of goat milk and the fattening of sheep;
- **Semi-intensive peri-urban systems:** these are made up of camels and cattle. These systems are found around the major cities, especially Nouakchott, and they are the work of traders and civil servants. The animals are fed by the search for natural pastures and food supplements. Indeed, in this pastoral system, the management mode tends to become more and more entrepreneurial insofar as the shepherds who lead the flocks (the bulk of the workforce) are permanent employees. The dispersal of livestock species across agro-ecological zones means that the cattle herd is mainly on the part between the 150 mm isohyet and the southern border of the country. The camel herd is nomadic for the most part north of the 400 mm isohyet, with the highest densities on the coasts where there are salt pastures very popular with the dromedary. Finally, the sheep and goat herd is scattered throughout the country, with high densities in the south and southeast.

The below table shows that in terms of pastoral systems, out of the 5 listed, those known as nomadic, sedentary livestock associated with agriculture, and extensive urban livestock farming are family farms and therefore belong to family farming. On the other hand, the so-called transhumant agropastoral and semi-intensive peri-urban pastoral systems are of a different type because of their management method and the use that is made of their production.

Table 28: Pastoral Systems in Mauritania

Pastoral systems	Speculation	Space	Workforce	Production Utilization
Nomads	Camels, goats	North (Jul-Sep) South (Oct-Feb) Water points (Mar-Jul)	Family	Self-consumption
Transhumant agropastoral	Cattle, sheep, goats, camels	Mali, Senegal (transhumance duration decreasing)	Mostly salaried	Savings & Marketing
Sedentary livestock farming associated with agriculture	Cattle, sheep, goats	Local terroir	Family-owned, temporary employee	Self-consumption, marketing
Urban Extensives	Goats, sheep	Urban Centres	Family	Self-consumption, marketing
Semi-intensive peri-urban	Camels, cattle	Large urban centres	Family-owned, permanent employee	Commercialization

Source: FAO, CIRAD, CIHEAM-IAMM 2017

7.2.2.3.3. Information on the most promising sectors

In Mauritania, the sale of live cattle and livestock-based products is the main source of income for livestock farmers. The annual production potential is estimated at 180,000 tonnes of red meat, 213,000 tonnes of milk

and nearly 5 million pieces of raw skins (APIM, 2021). Mauritania is a live livestock production and consumption basin that is part of a larger, subregion-wide trade in which producing countries exchange their livestock for other agri-food products. The coverage of meat needs by national supply makes it possible to generate an estimated surplus of 40% of the national production exported live in the sub-region (Source: NLDP 2018).

Pastoralism is based on the exploitation of natural water and grazing resources. As a result, their availability has a direct impact on the production (or loss) levels of transhumant herders. Not only must water resources be available, but their network is also important (mesh between water points, their right-of-way areas and pastures). Excessive removal of one of these resources for too long a period of time can jeopardize the performance and even the viability of the pastoral system.

The active actors in the red meat sector are estimated at 105,385 farmers, 10,000 livestock traders, 2000 goatherds and 5,000 butchers (NLDP 2018). There are far fewer operators working in the other sectors and organised. There are 7 significant professional organizations. The potential of the various sectors of the livestock sector is very promising, particularly in terms of the production of red meat, milk and its derivatives, leather, as well as opportunities for the development of the poultry sector.

For the milk and dairy products sector, the country now has several local companies processing milk into various products (long-life milk, fermented milk, yoghurts, cheeses) from cow's, goat's and camel's milk. Local production is mainly self-consumed. The growing demand for milk and dairy products has facilitated the establishment of five dairy processing units (Société mauritanienne des industries laitières (Tiviski), Société laitière de Mauritanie (Toplait), Watania, Sava and Iriji) all located in Nouakchott, and small milk production units throughout the country.

The pasteurization plants are supplied through a milk collection system produced by semi-intensive and peri-urban livestock farms (transhumant or sedentary). These collection systems are organized with modern means (vans, tankers, etc.). The milk sector involves several actors: producers, collectors, manufacturers, consumers, socio-professional organisations whose mapping has yet to be specified. In addition, with a view to rationalizing and developing milk production, pasteurization plants organized livestock farmers; This has made it possible, in addition to the increase in farmers' incomes, to better manage the herds, which are better fed and cared for. The milk sector involves several actors: producers, collectors, manufacturers, consumers, socio-professional organisations whose mapping has yet to be specified. The milk and dairy products sector therefore benefits from significant demand on the Mauritanian national market, supported both by the traditional consumption of fresh or curdled milk throughout the year (linked to nomadic eating habits) and by a growing urban consumption that gives pride of place to these products. However, imports of sterilised milk and milk powder remain significant (9,000 t in 1995, 13,000 tonnes in 2000 and 30,000 tonnes in 2016) and compete with local production (NLDP 2018)

The leather and hide sector has significant production potential, but it is still in its infancy, but its products remain insufficiently exploited. A significant production potential estimated at 108,100 cattle hides, 2,583,000 small ruminant skins and 100,260 camel hides. The willayas of the two Hodhs, Assaba, Trarza, Gorgol and Brakhna are traditional areas for the slaughter of cattle and the production of hides and skins. Tanneries are polluting and consume a lot of water. There are two hide processing units in Nouakchott that process 1,500 to 3,000

skins per day (under capacity). The piles of horns and hooves in the vicinity of slaughterhouses pose public health problems.

The commissioning of the Nouakchott slaughterhouse and its planned extension for the slaughter of small ruminants, the organization of the system for collecting skins and their processing, would make it possible to develop the export of these by-products, which are currently clearly undervalued. A policy has yet to be put in place to improve the quality of skins at the farm and slaughter level, to expand the collection circuit and to invest in treatment units. The sector involves several players, including producers, collectors/intermediaries, transporters, wholesalers, butchers, buyers, processors, foreign investors, and socio-professional organisations. Almost all production is exported in the form of raw hides and skins (washed and dried in the shade or sun, salted or without treatment) to Europe (France, Italy, Spain), West Africa (Senegal, Mali, Ghana) and the Maghreb (Morocco). The exportable potential of hides is equivalent to 185,000 cattle and 4,000,000 small ruminants.

7.2.3. The main agricultural products

The main agricultural products are:

- **Rice production:**

Rice production is the main crop grown mainly in the four wilayas of the Senegal River valley, namely those of Trarza, Brakna, Gorgol and Guidimakha, at the level of the irrigated perimeters located on the banks of the river, its tributaries and tributaries, including the areas of R'kiz and Foum Gleïta located further back. With the exception of market gardening, rice occupies almost all of the land developed in irrigated areas with total control of water. Rice farms are divided into 3 categories: (i) large collective areas (traps) where the management and maintenance of irrigation facilities are entrusted to farmers' organizations; (ii) village perimeters allocated to smallholder family farmers; (iii) and private operators or traders.

At the level of the collective perimeters managed by the village cooperatives, the farm is fragmented and cramped with plots of an average size of about 0.7 ha. These farms are not very mechanized and rely on family labour, which is increasingly limited because of the emigration of young people and the most able-bodied workers. This raises the problem of the ability of the households to exploit larger areas even if the areas they currently have do not allow them to cover their own consumption needs.

Rice producers are of two types: (i) small producers organized in cooperatives, located all along the valley of the river and its branches (Foum, Rkiz, Koundi, etc.) and whose vocation is to ensure the food security of their households; (ii) "individual" producers who are promoters/investors for commercial purposes.

For the 2022-2023 season, rice plots occupied an area of 72,379 ha for a total production of 410,201 tonnes (source: Ministry of Agriculture).

- **Production of traditional cereals:**

Traditional cereals are closely linked to climatic hazards: droughts, floods, silting, water erosion and wind in poor soils, Depending on the year, the total UAA can vary almost twice as much and 86% of the production of traditional cereals is carried out outside irrigation areas, and is therefore totally dependent on rainfall.

Traditional cereal cultivation (millet, sorghum, maize) is dominated by small family or collective farms, with rudimentary agricultural practices and oriented towards self-subsistence. It has not yet seen the improvements that would enable it to contribute more to improving food security and reducing rural poverty.

The size of farms varies according to the production areas, the traditional legal status of the land and the categories of farmers. Although it is highly variable, the average farm size is estimated at 1.7 ha for dieri, 1.32 ha for lowlands and 0.6 ha for walo (source: NADP). The farm is based on manual labour based on family labour, and generally archaic working tools (daba, hoe, burrowing stick).

At the small-farm level, the producers are small-scale farmers who cultivate the cereal-dominated fields of the Diéri, Walo, lowlands and crops behind dams. Their organizations are formal (cooperatives, user associations) or informal (village development committees, infrastructure maintenance committees).

For the 2022-2023 season, rice plots occupied an area of 300,696 ha for a total production of 145,940 tonnes (Source: Ministry of Agriculture).

- **Wheat Production:**

Mauritania is a major consumer of wheat and almost totally dependent on imports. Introduced with the date palm, wheat has traditionally been grown on very small irrigated plots at the level of the oases and receding in the lowlands and behind dams, mainly in Tagant, Assaba and Adrar. RSDS has paid particular attention to this sector, which is considered to be sufficiently promising due to the strong growth potential it offers. But production struggled to take off.

Wheat cultivation is practiced in irrigated areas and behind dams and dikes, in the wilayas of the East (Hodh El Gharbi), the centre (Tagant) of the River (Trarza and Brakna) and the north (Inchiri, Adrar).

Wheat cultivation is carried out in the cold off-season at the level of (i) irrigated perimeters with small and large plots such as those cultivated with rice by collective and individual producers, and (ii) at the level of cultivation areas behind dams and dikes with the same structure as sorghum fields. However, in the absence of a fertilization practice, there is a risk of rapid land depletion.

For the 2022-2023 season, wheat plots occupied an area of 737 ha for a total production of 1,504 tonnes (Source: Ministry of Agriculture).

- **Market gardening**

In irrigated areas, the most widely grown market garden species are sweet potatoes, tomatoes, cabbages, onions, peppers, turnips, carrots and potatoes. The carrot is the predominant speculation in the oases. Peri-urban market gardens mainly produce mint, onions, turnips, carrots, tomatoes and cabbage.

The main production areas are: the irrigated perimeters of the Senegal River Valley; the peri-urban area of Nouakchott and Nouadhibou; oases; flood recession areas (in particular the Walo de Maghama); the peri-urban areas of the other major cities, including Kiffa, Aioun, Selibaly, Kaedi, Boghé, etc.

The fruits produced are bananas, mangoes, watermelons and dates. Only bananas are beginning to be invested in the Trarza region (river valley area).

Small-scale market gardeners are often grouped together in groups that share investments (fencing, supply system and water drainage), but each individual cultivates plots that vary from 20 m2 to 40 m2. All cultivation operations are carried out manually. Water-saving irrigation techniques (drip irrigation systems) are still very little used.

For the 2022-2023 season, market gardening plots occupied an area of 5,235 ha for a total production of 104,700 tonnes (Source: Ministry of Agriculture).

- **Phoenicicultural production**

Phoeniciculture is the main activity of the oasis production system where date palm remains the most economically profitable crop. According to the 2012 date palm census (no updated data), national production is estimated at about 58,000 tonnes, or a yield of 31.5 kg per plant. All date palm by-products are used in Mauritania: (i) dates are used to feed the population; (ii) palm leaflets and kernels feed domestic animals; (iii) the wood of the stipe, as well as the main vein and petiole of the palms, are used as building materials and for crop protection against lodging.

The total area of the oases is about 4,800 ha, a third of which is in the wilaya of Adrar alone, and 25 to 30% in each of the wilayas of Assaba and Tagant, the rest being located mainly in Hodh El Charghui in the south-east of the country.

- **Sugar production**

Sugarcane cultivation has recently been introduced in Mauritania as part of the creation of an agro-industrial complex for sugar production. This is an initiative that the Government has undertaken to implement structuring development projects, as well as to launch, among other things, the production and industrialization of a product that is highly consumed by the population. In this regard, in December 2011, the Mauritanian State created the semi-public company called Société de Sucre de Mauritanie, whose statute was revised in 2013 to become a public limited company called Compagnie Mauritanienne de Sucre et Derivatives. As part of this public-private partnership, the State has made 17,000 hectares downstream of the Foum Gleïta dam available to the project and has initiated several contacts with private partners to mobilize financing. As it stands, the project has been able to start with financial resources from the State. Negotiations are underway with various partners. This project has two components: (i) the agricultural component concerning the production of sugar cane, and (ii) the industrial component which includes the sugar refinery/refinery for the production of white sugar. From sugar cane, the project provides for an ethanol production unit with a capacity of 10 million litres per year, a feed plant with a capacity of 5,000 tonnes per year and a fertiliser production unit, as well as energy production. It also provides for the creation of 2,000 permanent jobs and 1,000 seasonal jobs.

- **RSDS 2025 targets**

In terms of agricultural production, the objectives set by the RSDS for 2025 are as follows:

Table 29: Agricultural production targets for 2025

Spinneret	Area (ha)		Yield (t/ha)		Production (T)		Coverage of needs (%)	
	2012	2025	2012	2025	2012	2025	2012	2025
Rice	31 000	63 000	5,1	6,05	158 000	379 000	57	115
Wheat	2390	65 880	1,02	3,51	2 430	231 000	1	70
Traditional cereals	114 000	162 000	0,32	1,95	36 000	316 000	16	1000
Potato	120	1 214	25	42	3 000	51 000	10	100
Onion	353	2 766	17	36	6 000	47 000	17	100
Other market gardening products	430	3 980	19	25	9 000	98 000	6	47
Date palm	11 380	15 400	4,146	5,025	47 000	76 000	91	121
Sugar crops	5	20 000			0	177 313	0	84

Source: RSDS 2013-2025

7.2.4. Constraints and challenges

7.2.4.1. Climate Change and Threats

Climate change and its foreseeable effects on Mauritania are worrying. According to climate scenarios (IPCC, 2007), the climate will evolve over the next twenty years towards greater aridity, an increase in the frequency of extreme weather shocks and a decrease in precipitation. The country is expected to experience a high socio-economic and ecological exposure to climate hazards, which are likely to cause considerable and detrimental impacts that are still poorly documented, particularly in terms of understanding the socio-economic costs that would result. This development would be characterized by negative impacts in the short term, including:

- at the land level: progressive soil erosion, a reduction in the latitude of pastoral rangelands, and a decrease in the usable agricultural area;
- At the coastal and marine level: a gradual and aggravated weakening of the barrier beach, a development of lagoons and a probable reopening to the ocean, a disappearance of the coastal plain and a fluctuation in fish stocks linked to the variation of the thermal front.

The Mauritanian population, which is mostly rural, is particularly affected by climate change insofar as it conditions water, food, forestry and financial resources with direct repercussions at the local and national levels. Production systems in rural areas (agriculture, livestock, and exploitation of wood and non-timber forest products) are highly dependent on climate, including rainfall.

As a result, the country has experienced several decades of drought, which has led to severe degradation of natural resources and human-induced desertification, with direct consequences for an already very fragile natural environment, namely the deterioration of the country's socio-economic conditions and the impoverishment of the rural population: (i) significant degradation of agricultural land and limited surface water resources; (ii) gradual loss of the contribution of rain-fed agriculture to the national economy; (iii) annual use of

imports and food aid for major cereals leading to a trade deficit; and (iv) limited access to food resources due to poverty.

Pressures on biodiversity are numerous, leading to definite threats to fauna and plant resources. The vegetation cover, which is poor overall, is mainly dependent on rainfall. The coastal and maritime zone is subject to great anthropogenic pressure of overfishing (linked to the considerable presence of trawlers and pirogues) and a sometimes unreasonable installation of socio-economic infrastructures on the coast (ports, hotels, factories).

In addition to the risks related to the vulnerability of the national economy to exogenous shocks, the impacts of climate change will particularly affect vital sectors of the national economy such as water resources, agricultural and livestock production, the coastal economy and natural ecosystem services. Ultimately, the pressure on natural resources will be more sustained for rural populations who derive most of their income from the exploitation of these resources (RIM, 2014).

At the national level, water access rates are low and large inequalities in access remain, on the one hand between regions and, on the other hand, between under-equipped peri-urban and rural areas and better-served urban centres. The rate of access to drinking water in rural areas was 72% in 2021. Approximately 600 million m3 of water (70% of which is used for agriculture) are mobilized each year in Mauritania. Abstractions come from groundwater (about 25%), surface water (about 25%) and the Senegal River (about 50%) (WHO and UNICEF, 2022).

As the stability of food production in agropastoral and oasis areas is threatened by the unsustainable management of water resources, the interest in the issue of sustainability consists in better understanding the involvement of food systems in the development of sustainable practices that would allow a more efficient use of this resource.

7.2.4.2. Anthropogenic pressure and degradation of natural resources

Mauritania, a Saharo-Sahelian country, is in an environmental situation characterized by a highly fluctuating rainfall pattern and an overall deficit. The strong trend towards desertification (silting, deforestation, loss of biodiversity, degradation of soils and ecosystems, etc.) has slowed down slightly in recent years thanks to relatively favourable rainfall and several effective efforts and regulatory measures (e.g. reforestation, erosion control, regulation of the wood energy sector, etc.). Nevertheless, the trend towards the degradation of natural resources continues, driven by persistent poverty in rural areas and unsuitable ways of exploiting natural resources (Source: NESDS 2017).

- **Soils and land**

Land degradation is very significant and affects about 220,000 ha, or about 20% of the agricultural and wooded areas used by humans (MESD, 2010). A serious problem of desertification persists despite considerable efforts to combat silting up and stabilize the dunes by all actors in society and their development partners (TFPs). Population pressure leads to the exploitation of poor soils and the reduction of vegetation cover, in particular through the transformation of forests and woodlands, overgrazing and bush fires promote an acceleration of wind and water erosion in the event of rain. Between 1974 and 2004 (absence of more recent figures), 150,000

km², or 15% of the national territory, were transformed into desert areas (MESD, 2012), i.e. land, degraded and difficult to rehabilitate. The mobilization of soils and substrates by accelerated wind erosion is causing silting up that threatens the entire country, including the capital. For several years, the government has made substantial investments to protect the capital against the effects of desertification and silting, and the continuation of dune stabilization measures is essential for the protection of the capital. In addition, the coastal dune barrier has experienced significant degradation and destabilization as a result of the uncontrolled exploitation of the sand used by the booming construction sector. This also increases the transport of sand by the wind and represents a high risk of salinization of the soil and also of the aquifers by the intrusion of the sea. In addition, there are cases of soil salinization in the Senegal River delta following the construction of the Diama dam. Salinization of agricultural land, caused by poor management of wetland water levels, and pollution caused by poor management of pesticides and fertilizers, are observed in a few places, particularly in irrigated areas. This situation can cause enormous damage to the soil, especially in the Senegal River valley and the areas of its tributaries.

- **Surface and groundwater**

Water quality has deteriorated as a result of the consequences of the drought of the 1970s and anthropogenic action. This has led to the phenomena of salinization, silting up of watercourses, sedimentation, proliferation of invasive aquatic plants and various types of pollution, in particular caused by poorly adapted irrigation techniques leading to the infiltration of fertilizers and pesticides. Pollution of the river by irrigation and salinization has been observed several times and overexploitation of groundwater has been observed in several oases (Abdel Kader Ould Mohamed-Saleck, 2010). There is no systematic monitoring of water quality outside of drinking water quality analyses, but the risk of pollution must be considered to be increasing given the relatively small sewerage and wastewater treatment systems, especially in rapidly developing urban and economic centres.

- **Natural pastures**

The potential of pastures, depending mainly on the Sahelian ecosystem and the ecosystem of the river zone, amounts to 13,848,000 ha, or about 14% of the total area of the country (source: NWCS 2014). About 479,000 ha/year are destroyed by bush fires, this corresponds to about 10 billion ouguiya in livestock feed equivalent. The evolution of livestock farming has led to a more than tripling of cattle and a doubling of goats and sheep between 2001 and 2015. This situation increases pressure, overgrazing and the risk of degradation of Sahelian ecosystems. In addition, the trend towards sedentarization of nomadic herders, only 5% today, accelerates overgrazing, particularly around ponds and human settlements. The current grazing deficit is around 1 to 2 million LSU/year. Typically, this deficit is compensated by aerial grazing (forest NTFPs and other woodlands), increasing pressure on forests and other woodlands (NBSAP, 2011-2020).

- **Ecosystems**

Ecosystems, particularly in the Sahel, and wetlands (oases and ponds) are highly unbalanced by the effects of droughts and especially by human activities, which are poorly adapted to the fragility of natural systems, natural weather-climatic variation and the potential for natural regeneration of resources. Natural ecosystems thus suffer from fragmentation, transformation and loss of interconnectivity, especially in areas with relatively high human presence (through roads and infrastructure, the expansion of agriculture, the increase and reduced

mobility of livestock and the increase of towns/villages and mining areas). The overexploitation of resources causes the disruption of the balance of systems and the modification of all ecosystems with the impoverishment of diversity and the sharp reduction of the ecosystem services offered by nature to man for his needs in food, energy and drinking water.

- **Biodiversity**

Terrestrial fauna is strongly threatened by the effects of overhunting in the past before the complete ban on hunting and by the destruction/degradation of habitats with the disappearance of all large mammals including the 'flagship' animals of the desert (oryx) and the sharp reduction in quantity and diversity of all fauna.

The last and only inventories date back to the 1980s, but wild flora has experienced the same trend of impoverishment of its diversity and density. 22 native plant species threatened with extinction have been fully protected by law, but there is a gradual disappearance of wild plants important for food, the replacement of endemic wild species by cultivated plants. In addition, the disappearance of vegetation gives rise to sand movements and badlands and the process of degradation of ecosystems continues. If the current trends of environmental degradation, and therefore of ecosystems, continue, the potential for enhancing the country's plant and faunal biological diversity will be lost and their rehabilitation will be long and difficult (NBSAP, 2011-2020).

7.2.4.3. Agro-climatic and technical constraints

In Mauritania, the exploitation of natural resources (water, land) is closely linked to improving the incomes of food system actors. The development of these resources is an important element for the development of agricultural value chains, which, for the time being, do not guarantee the livelihoods of these actors in a sustainable manner. They have to face the many challenges relating to (1) increasing and stabilizing production, (2) creating added value, (3) improving the organization of the marketing system and making local products competitive with imports.

To address these challenges, seven main drivers of the poor performance of agricultural value chains need to be considered: the impact of climate change, low public sector investment, insufficient adequate financial instruments for agricultural activities, inefficient production techniques, limited processing capacity, lack of organized distribution channels and discriminatory socio-cultural practices (FAO, EU, CIRAD 2023):

- **Low public investment in the agricultural sector does not allow actors to benefit from essential services for the development of value chains**

The public investment policy in the agricultural sector focuses on the construction of infrastructure that contributes to the development of crops and livestock. As part of the implementation of the third PRSP plan (2011-2015), significant investment efforts in the agricultural sector have been made, with public investment in the rural sector increasing from 5% in 2012 to 12% in 2020 (SOFRECO, 2012). The State has also set up structures for the training and supervision of family farming. However, Mauritania is still ranked among the countries that are not on track to meet the commitments related to the Malabo Declaration (AU, 2020). The country has not yet been able to operationalize research, training and extension services for the technical support of producers (MDR, 2016).

The study carried out by Enabel on the state of rural infrastructure in Mauritania in 2020 highlighted that the country faces certain difficulties in implementing public investments in the field of rural infrastructure (production and service). These difficulties are mainly due to the absence of national strategies for spatial planning and development, budget implementation constraints, the need to clarify the role of the administrations concerned, the absence of regulations and technical standards and the execution of works and their management.

In addition, local authorities do not have the technical and financial means to extend the coverage of their services to administrative and economic entities as well as to local populations. As a result, they are unable to develop development planning that would boost production and economic inclusion (World Bank, 2018). This results in a shortage of skilled labour in both livestock and agriculture, which weighs heavily on the performance of the rural sector (Marzin et al., 2017). The lack of supervision and the weakness of rural infrastructure affect producers in particular and force them to resort to traditional cultivation methods that significantly reduce their productivity. In addition, they are increasingly isolated and have difficulty sourcing inputs and selling their products.

- **Production systems under the constant threat of climate change affecting local productivity**

Agricultural value chains are largely dependent on climate. They are constantly under threat from climatic variation, which manifests itself in irregular precipitation and its spatiotemporal distribution, increasingly high air temperatures, and more frequent droughts and floods. This phenomenon leads to a decrease in the flow of water from the river, which affects almost all cereal and vegetable production. As a result, producers are forced to intensively exploit irrigated plots where sufficient water is available. This practice exacerbates soil degradation and weakens ecosystems, which in turn reduces agricultural productivity. Climate change is having a significant impact, particularly on family farming, which depends on rainfed crops, and large-scale livestock farming (IFAD, 2018).

- **Low use of inputs and high-performance tools**

According to the Ministry of Agriculture's analysis during the development of the National Agricultural Development Plan (NADP) in 2016, producers use few efficient inputs (seeds, phytosanitary products and fertilizers) on their farms. Indeed, producers' access to quality inputs is very limited due to their low purchasing power and the fact that these inputs are not sufficiently available on the market or at the level of public services. Even if they are available, the departments in charge of controls have difficulty tracing the quality and use of these inputs. As a result, the seeds are not adapted to the agroclimatic conditions of the production areas. In addition, the characteristics of agricultural developments prevent the mechanization of crops, especially of small farms. The plots of land in the collective perimeters are very fragmented and cramped, with an average surface area of about 0.7 ha. The development of these plots is essentially based on family labour and a low use of mechanised tools. This situation is exacerbated by the dilapidation and deterioration of the perimeters, the poor quality of the facilities (lack of levelling, lack of drainage, poor levelling), the absence of a sustainable management and maintenance practice for hydro-agricultural structures, and the emigration of young people (MDR, 2016). All of these practices limit the ability of producers to exploit larger areas and also reduce the possibility of meeting their self-consumption needs.

- **Low processing capacity limits the ability of food systems actors to create added value and improve their incomes**

In general, the low number of agricultural processing units is due to the lack of structuring infrastructure for opening up rural areas and the absence of rural electrification. This leads to dispersion and fragmentation of production units and does not allow for economies of scale (MDR, 2007). Despite recent progress, Mauritania lags behind its regional neighbours and below the sub-Saharan African average in the Ease of Doing Business Index, ranking 176th out of 189 (World Bank, 2015).

The low processing of agricultural products in Mauritania can be explained by several factors, including the lack of machining technology, the poor quality of processing machinery and the consequence of inadequate storage of grains (MDR, 2016). This is particularly the case for cereal products where, due to a lack of adequate equipment, the yield of cereal processing, particularly extraction in rice mills and husking mills, is very low (57%).

As for the market gardening sector, it faces conservation and storage problems resulting in enormous losses. In addition, it faces financial difficulties preventing investors from setting up efficient processing units. Financial institutions show little interest in granting credit to producers and potential processors of vegetable products (IFAD, 2019). As a result, processing in this sector is almost non-existent.

All these conditions make local products less competitive with imports and reduce the investment capacity of food system actors.

- **Lack of adequate financial instruments**

Currently, there are no financial products tailored to the specific needs of different types of actors involved in all links in value chains (IFAD, 2019). Individual farmers have difficulty obtaining funding, while farmers' organizations struggle to organize. In addition, the procedures for granting loans are very poorly adapted to the conditions and objectives of farming (diversification, intensification, processing). According to the World Bank, in 2015, nearly one-third of all businesses in the country complained about lack of access to credit and banks that offer a higher credit rate than the sub-Saharan average. At the level of actors, especially small-scale producers, this situation has an impact on their investment capacity and endangers the resilience of their livelihoods.

- **The lack of organized distribution channels and the low level of professionalization of actors affect the competitiveness of agricultural products**

The difficulties in the sale of agricultural products in Mauritania are the result of a number of problems, including: the poor coordination and professionalization of the actors in the sectors and the absence of a consultation framework, the poor performance of value chains (limited production, high cost of production factors and poor storage and transport conditions), the absence of an effective market information system, the lack of an organized distribution channel and strong competition from products imported from Europe, Morocco, Senegal and Mali (IFAD, 2021). Indeed, the lack of elasticity of the cultivation calendar forces market gardeners to produce and dump everything on the markets at the same time, causing saturation and a drastic drop in prices. This is exacerbated by poor knowledge of improved post-harvest techniques, inadequate adequate infrastructure (packaging, storage) and poor conditions for transporting products.

- **Discriminatory socio-cultural practices that prevent women's access to productive resources and their economic development**

Access to factors of production is unfavourable to women in Mauritania. This includes land, credit, and various technical and economic opportunities. Land management is the domain of men; only 18.7 per cent of women in Mauritania own land and women make up only 8 per cent of landowners or property owners. Land distribution is carried out according to a collective and tribal management system that allocates land to men. In terms of agricultural financing, there are disparities in access to credit between men and women, both economic (lack of regular income, difficulties in providing collateral) and socio-cultural (illiteracy, lack of appropriate information system for women, lack of training and experience in credit/savings). Inequalities in access to factors of production have a decisive impact on the ability of young people and women to carry out income-generating activities, particularly with regard to agro-pastoral investments.

7.2.4.4. Food dependency and the extent to which nutritional needs are met by national production

The country is facing recurrent shocks, especially agroclimatic, resulting in repeated cycles of drought (2008, 2011, 2014, 2017, 2021) that have eroded livelihoods and damaged ecosystems. This situation is further exacerbated by locust invasions, rapid soil erosion and desertification due to climate change, inadequate agro-pastoral practices and increased human and animal pressure.

Crop food production is seasonal and comprises four major crop groups: (i) cereals; (ii) roots and tubers; (iii) oilseed crops (desert date palm, sesame) and (iv) fruits and vegetables. The evolution of the production indices of these crop groups in relation to population change from 1961 to 2017 is shown in the below Figure.

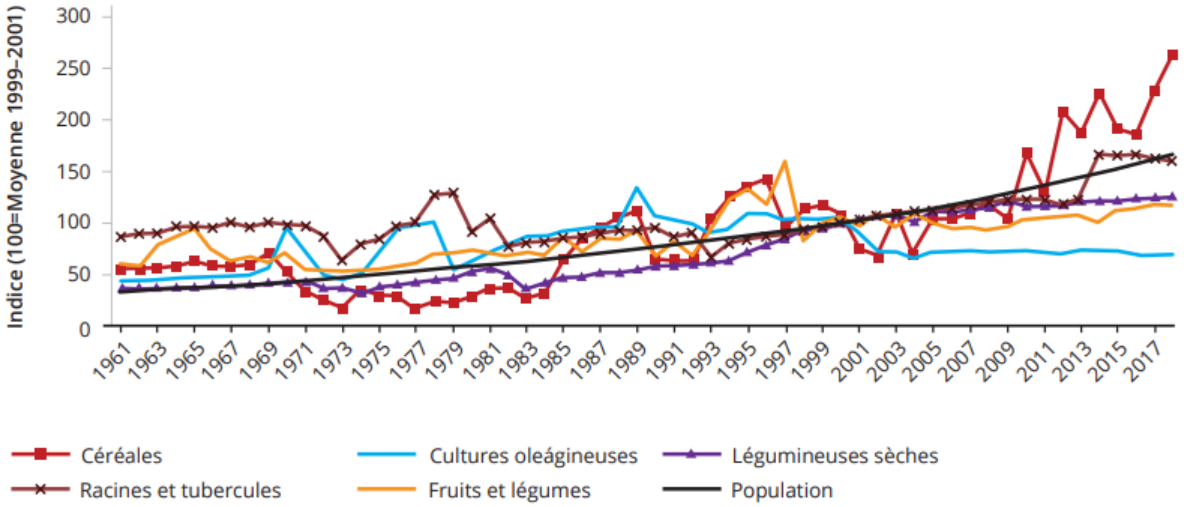


Figure 19: Evolution of crop food production indices in Mauritania in relation to population change from 1961 to 2017.

Source: AP2 AGSPS, 2021-2025

Generally speaking, production volumes have been increasing in the majority of crop sectors since 1980. These results are the result of improved yields for certain commodities, such as wheat yields, which have increased fourfold since 1980, and paddy rice yields, which have increased fivefold since 1970. On the other hand, crops

such as maize, millet and sorghum experienced stagnation in yields from 1961 to 2019 and the increase in their production would be the result of the increase in cultivated areas.

With an estimated need for horticultural products estimated at 435,469 tonnes by 2025 and a level of imports by volume of 105,062 tonnes in 2018 (MDR, 2019), the horticultural sector has shown great dynamism over the last ten years. This is due, on the one hand, to the consolidation of strategic productive poles (valley, oasis zone) and to the increase in demand in rainfed areas due to greater consumption of vegetables by rural populations, and, on the other hand, to national policies for agricultural development and support for the growth of the sector. This dynamism is fostered by the existence of pedoclimatic conditions favourable to market gardening in several of the country's production areas and by real domestic demand, the satisfaction of which is largely supported by women's activities. The range of horticultural products is very diverse and two groups can be distinguished, according to their origins and pedoclimatic requirements: vegetables from temperate regions (cabbage, lettuce, tomato, eggplant, beans, melon, carrots, turnips, potatoes, onions) and local or warm vegetables (cowpeas, chilli, okra, pumpkin, guinea sorrel [bissap], jaxatu [red eggplant], sweet potato).

Food and nutrition insecurity is highly correlated with low income levels, limiting access to food for a large number of Mauritanians. Climate change, environmental shocks, high population (2.74 per cent per year) and urban (4.29 per cent per year) growth, deterioration in foreign exchange rates, lack of productivity and low yields affecting rural populations who live mainly from agro-pastoral activities, are also key factors affecting the proper functioning of food systems.

Mauritania's food systems are highly dependent on food imports, particularly cereals, which accounted for USD 218.4 million in 2018.

Moreover, since 2000, cereal imports have accounted for between 29 and 50 per cent of total food imports, which have quadrupled over the same period, indicating the country's high dependence on imports. For cereal products, the dependency level reached 64% in 2019.

According to the Ministry of Rural Development (MDR, 2019), Mauritania's vegetable imports have continued their steady growth since 2014, reflecting an increase in demand due to significant population growth combined with improved living standards in major urban centres. In 2018, for example, Mauritania's vegetable imports amounted to USD 24.9 million. Such foreign exchange flight is detrimental to the national economy. The main vegetables imported are: (i) onions for USD 14.3 million; (ii) potatoes for US$8.1 million; (iii) carrots for USD 1.4 million; (iv) sweet potatoes for US$396,000. This situation clearly shows the products for which a sustainable production strategy should be considered to reverse this trend.

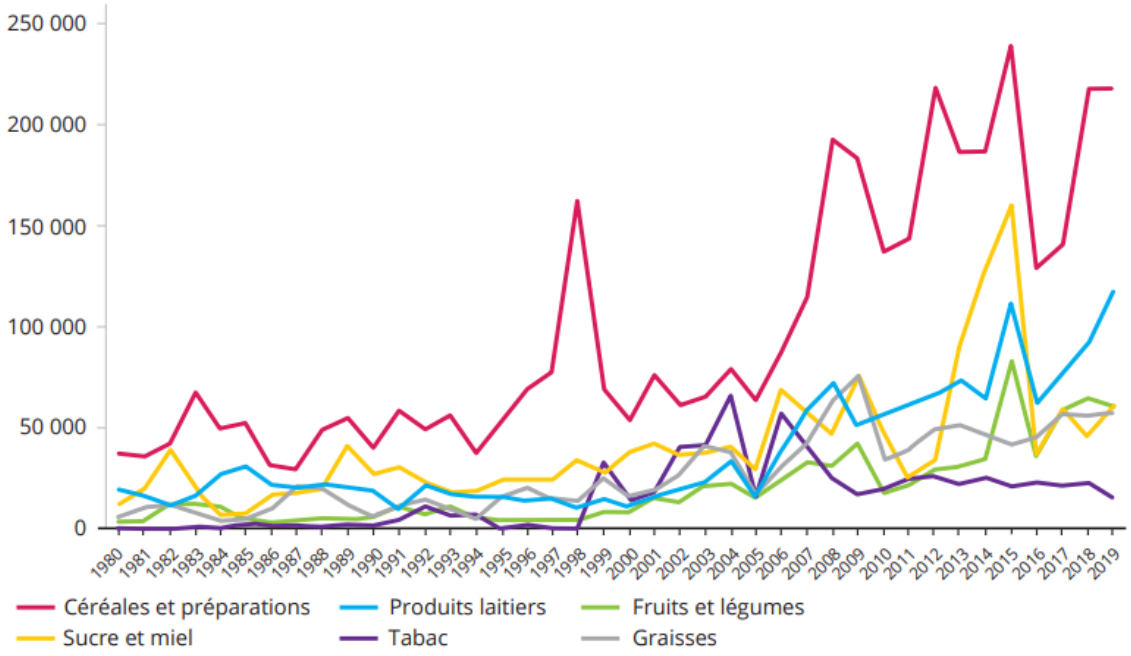


Figure 20: Main imports by value since 1980 (USD 1,000) in Mauritania.

Source: AP2 AGSPS, 2021-2025

7.2.4.5. The crisis in world markets and its effects

After a strong recovery in 2021 thanks to the decline of the Covid-19 pandemic and the lifting of barrier measures, the crisis in Ukraine has plunged the global economy into an unprecedented crisis characterized by historic and widespread price increases forcing central banks to abandon policies to support growth against a backdrop of stagflation risks. The crisis is already affecting the short-term outlook, exacerbating rising oil and gas prices, food prices and agricultural inputs, and disrupting supply chains. The global economy could be mired in a prolonged cycle of low growth and high inflation. Increasingly dark episodes in 2022 meant that risks were starting to materialize. Global output contracted in the second quarter of this year, driven by slowing activity in China and Russia, while in the United States, household spending fell short of expectations. Several shocks hit a global economy already weakened by the pandemic: higher-than-expected inflation around the world, particularly in the United States and the most economically important European countries, which caused a tightening of financing conditions; a sharper-than-expected slowdown in China following COVID-19 outbreaks and lockdowns; and further negative repercussions of the crisis in Ukraine. At the national level, the year 2023 is expected to see an economic growth of 4.7% compared to 5.9% in 2022 (Ministry of Finance, 2023). This slowdown is, for the most part, due to the recessionary effects of the various 4 factors that are clouding the global growth outlook. In addition, purchasing power is being eroded by rising prices, which are holding back domestic demand, despite a growth in gross domestic product in value terms of 7% in 2023 compared to 4.5% in 2022 (Ministry of Finance, 2023).

In 2021, inflation as measured by the national consumer price index trended upwards, reaching an annual average of 3.6% compared to 2.4% in 2020. Year-on-year, price inflation peaked at 5.7% at the end of 2021 compared to 1.8% in 2020 (Ministry of Finance, 2023). This upward trend in consumer prices was mainly due

to a sharp increase in the prices of food and non-alcoholic beverages of 8.9%. It reached 11.1%, year-on-year, in August 2022 compared to 6% in January of the same year, supported mainly by higher food and transport prices. It is expected to be around 10% by the end of 2022, then 8% in 2023 (Ministry of Finance, 2023).

7.2.4.6. The challenges and issues of the future

The transition to a green and blue economy in Mauritania following an inclusive and sustainable approach is in line with the first pillar of the Strategy for Accelerated Growth and Shared Prosperity (AGSPS) "Promoting strong, sustainable and inclusive growth". Access to water, renewable energy and the maintenance of biodiversity, with a focus on oasis areas, are among the objectives assigned. In the coming decades, the agro-pastoral sector will face three major challenges: (i) significantly increasing and diversifying (vertical and horizontal) production, adapting supply to growing demand, improving social and geographical access to food, reducing dependence on food imports, and increasing exports of products with comparative advantages; (ii) supporting demographic change by responding to the growing demand for food and by integrating young workers into the food value chains generated by changes in consumption habits and access to food products; and (iii) mitigating the effects of climate change through coherent and sustainable technical adaptation responses.

In this context, actions are underway or planned by the Government with the support of its partners: (i) implementation of the integrated water resources management (IWRM) approach for both surface and groundwater by involving all parties (local communities, the State and private investors); (ii) improved knowledge of water resources (hydrographic charts) to facilitate monitoring and protection; (iii) rational use of water resources, protection and rehabilitation of agricultural land and improved development of wetlands and irrigable land on the basis of tripartite agreements between the State, traditional owners and private developers (cluster development); (iv) solar and wind pumping coupled with suitable irrigation techniques (e.g. drip irrigation) that offer good water-saving opportunities.

The Green Climate Fund Country Programme sets out national climate change priorities for 2020-2025. These priorities concern all vulnerable sectors and/or greenhouse gas (GHG) emitters such as agriculture, livestock, the environment, fisheries, housing, hydraulics, transport and energy. The country has committed to reducing its GHG emissions by 22% by 2030. This ambition is essentially based on the development of renewable energies (60% of the energy available in 2030), mass transport and the national reforestation programme (3,000 ha/year). National adaptation priorities include protecting coastal cities from the risks of marine immersion, restoring biodiversity and ecosystems, developing agroecology, providing access to water, and strengthening the resilience of vulnerable populations.

It is therefore necessary that all plans or programmes for the intensification or diversification of agricultural activities take into account the impact on natural resources and the environment in general, and rationalize the exploitation of resources through appropriate tools and techniques for the promotion of sustainable economic and social development. In this context, the protection of the environment and the agroecological balance requires a strong involvement of stakeholders, especially local communities, and close collaboration between the various ministries, in particular those of agriculture, environment, livestock, water resources, land use planning and fisheries.

Adaptation techniques are being developed and their improvement will allow the promotion of three-storey crops in oasis areas (agroecological practice) which will contribute to consolidating the resilience of ecosystems. These include water and soil conservation and soil defence and restoration schemes (ESC/SDR) that improve the natural recharge of the water table, as well as actions to combat silting and reduce evapotranspiration.

In the area of sustainable management of animal resources, actions are underway or planned; These include, inter alia: (i) strengthening the management of pastoral resources; (ii) development of pastoral water resources (including rational management of surface water); (iii) the promotion of a green cold chain fabric (solar energy) for the preservation, transport, marketing and processing of livestock products; (iv) the enhancement of traditional knowledge and the improvement of animal health to increase the quantity and quality of livestock productivity and enhance the safety and well-being of producers and consumers.

In order to meet the demographic challenge, the agricultural sector must first of all accompany structural demographic changes marked by a rapid increase in an increasingly urbanised and sedentary population on the one hand and an age pyramid on the other, which shows a preponderance of those under 25 years of age (Figure 16). These structural trends raise crucial but no less ambivalent questions. On the one hand, the very strong population growth is the result of a decline in mortality, which is an achievement of health progress. On the other hand, the "cohort" of young workers that "floods" into urban centres is considered either as a "demographic bonus", Chapter 1: Contextualisation 11 Chapter 1: Contextualisation as a source of potential productive assets, or as a "burden" due to the increase in the number of urban dwellers and dependents to feed, and as a source of social tensions. Whatever the point of view, the main challenge is both to meet the growing demand for food and to capture the benefits of this demographic dividend by securing as many young workers as possible

And finally, with regard to youth employment, current agriculture can only continue to absorb a portion of rural youth; farms, as the size of farms is shrinking. Unable to find outlets in the rural environment and/or the modern formal sector, the alternative available to young workers is to live off expedients in the informal sector and/or to emigrate to neighbouring countries and countries in the North. Meeting the challenge of youth employment means completing the transition (or transformation) towards an integrated urban and rural economy. Changes in consumption patterns and access patterns to food products are leading to the development of new activities along food value chains. The activities generated represent a significant potential for employment for young people. The latter could invest in short-cycle livestock farming (especially urban livestock) and be involved in agri-food sectors (in production, processing, transport and sales).

7.3. Strategies Adopted

In 2000, Mauritania drew up a Poverty Reduction Strategy Paper (PRSP) for the period 2001-2015, which was established in 2001 as the Poverty Reduction Orientation Law, making this document the reference for medium- and long-term economic and social development.

Prepared in the context of the enhanced HIPC Debt Reduction Initiative, the PRSP has always been the subject of a broad consultation based on a participatory approach, involving the Administration, elected officials, civil society, the private sector and Technical and Financial Partners.

Initially, the PRSP was based on four strategic axes: (i) accelerating economic growth and stabilizing the macroeconomic framework; (ii) anchoring growth in the economic sphere of the poor; (iii) human resource development and expansion of basic services; and (iv) improved governance and capacity building.

During the preparation of the second action plan for 2006-2010, a fifth cross-cutting axis was introduced, focusing on strengthening steering, monitoring, evaluation and coordination. In 2010, a new review was initiated with the aim of drawing up a third action plan covering the period 2011-2015. This revision is based on the assessment, the diagnosis, the lessons learned from the implementation of the CSPL II as well as the outlook for the period 2011-2015.

Since 2016, public development action in Mauritania by 2030 has been framed by the Strategy for Accelerated Growth and Shared Prosperity (AGSPS). This reference framework for strategic planning for the country's economic, social and environmental development also incorporates the United Nations 2030 Agenda for Sustainable Development (SDGs). In addition, the AGSPS has been the subject of an orientation law that makes it possible to establish it as a reference framework for development interventions carried out by the Government with the support of its technical and financial partners (TFPs).

The vision for the future, entitled "The Mauritania we want in 2030", aims to achieve strong, inclusive and sustainable economic growth, with a view to meeting the basic needs of all citizens and ensuring their social well-being.

After an initial action plan for 2016-2020 was evaluated, the second action plan for AGSPS is being developed to cover the period 2021-2025. According to the initial ambitions for the second five-year term of this strategy, it is expected that the economy will be more diversified and competitive, with a significant growth rate capable of absorbing social deficits and putting Mauritania on a sustainable development trajectory. To achieve this, three converging levers are the strategic objectives chosen to ensure this growth, which can achieve prosperity that benefits all.

- *Strategic Lever 1*: Promote strong, sustainable and inclusive growth;
- *Strategic lever 2*: Develop human capital and access to basic social services;
- *Strategic lever 3*: Strengthen governance in all its dimensions.

It is important to note that this second Action Plan comes in a context marked by the Covid-19 pandemic. Its development followed the governance scheme of the AGSPS by involving the Sectoral Development Committees and involving all stakeholders. It also takes into account Mauritania's international commitments (2030 Sustainable Development Goals, African Union Agenda 2063, Nairobi Commitments on the ICPD, 2021 N4G Commitments, 2021 SSF Commitments, signed specific agreements, etc.). Cross-cutting issues (Gender Dimension, Environment and Sustainable Development, Leave no one behind, etc.), sectoral and regional strategies being implemented as well as the President's Extended Priority Programme (ProPEP) launched in January 2020 and focused on improving purchasing power, job creation and access to basic services are also taken into account.

7.3.1. Definitions of Agricultural Strategies

The first Rural Sector Development Strategy (NRSDSS) was developed in 1998 and brought into line with the Poverty Reduction Strategy Paper in 2001. However, this first strategic document did not help to drive the changes relating to the successive implications of the private sector and the State for the development of the agriculture and livestock sectors during the 2000s. This strategy, defined for 2015, has also not been the subject of an evaluation to verify the relevance of the strategic choices made. The 2007 review of the rural sector recommended that the RSDS be updated and that an action plan be put in place to ensure its effective implementation.

In 2012, an Agropastoral Orientation Law (APOL) was drafted and adopted in December 2012. Its purpose is to determine the policy guidelines constituting the reference framework for the development of agriculture (crop and animal production). As an agricultural planning tool provided for in the APOL, a Rural Sector Development Strategy (NRSDSS) to 2025 was developed and adopted in 2013.

The Ministry of Rural Development (MDR) 49 wanted it to determine the conditions for developing the country's agro-pastoral potential and natural resources. The aim is not only to contribute to the objectives of reducing poverty in the rural sector and food insecurity as defined by the Agropastoral Orientation Law (APOL) and the National Food Security Strategy (NFSS) updated in March 2012, but also to meet the needs of national and regional markets by 2025, particularly due to population growth in the region and on the entire African continent.

7.3.1.1. National Food Security Strategy (NFSS) 2012-2015 and Vision 2030

Mauritania developed its National Food Security Strategy (NFSS) in 2012 for 2015 and Vision 2030

Its overall objective is to "enable populations, especially the most vulnerable, to have physical and economic access to sufficient, healthy and balanced food at all times".

The specific objectives of the NASS are to:

- Promote a rural and peri-urban economy that is socio-economically profitable, diversified, and adapted to climate change;
- Improve intra-national, cross-border and regional trade and trade channels;
- Sustainably improve access to healthy and balanced diets for vulnerable groups in rural and urban areas;
- Strengthen food crisis prevention and management mechanisms at the central and decentralized levels;
- Promote good governance of food security in a process of decentralization and local development.

The NFSS supports the revival of crop and animal production with a view to promoting food security, in particular through: (i) land reform to ensure land security for those who exploit it; (ii) the protection of local production in order to regain the internal market, as well as the improvement of the competitiveness of such production; (iii) financing policies adapted to the rural world and aimed more particularly at crop production, irrigation and

[49] MDR split into two ministries (agriculture and livestock) since 2020

livestock; (iv) policies for the valorization and processing of products; (v) capacity building of producer organisations; (vi) the reforms necessary for the implementation of agricultural research adapted to the needs of producers and appropriate advisory support; (vii) promoting youth employment; (viii) gender mainstreaming; and (ix) an effective decentralization policy and good governance.

The NFSS leads to a National Agricultural Investment Programme/ Food Security (NAIP/FS) which is structured around four pillars and ten programmes, each comprising a number of activities and projects to achieve the specific objectives:

Table 30: Mauritania's NFSS Pillars and Programs

Pillar	Programs
Pillar 1: Land and water management	•Programme for the Protection of the Environment and the Fight against Desertification and Silting.
Pillar 2: Market access	•Programme for the improvement of market infrastructures and trade channels.
Pillar3: Food Supply	• Agricultural Development Programme; • Livestock Development Programme; • Fisheries Development Programme; • Programme to strengthen the early warning, prevention and management of food crises; • Programme to improve access to food and drinking water; • Programme to support financing systems and the creation of income-generating activities.
Pillar 4: Agricultural research	• Programme to strengthen research, training and extension and advisory support; • Support programme for local development and good governance

Source: NASS 2012-2015

The total amount of the costs of implementing the NAIP/FS and the NFSS has been estimated by 2020 at 31 billion 63 million MRU, i.e. about 976 million USD, 38% of which is allocated to agriculture: 38% and 6.3% to livestock.

7.3.1.2. National Rural Sector Development Strategy (NRSDS) Horizon 2013-2025

The Rural Sector Development Strategy is defined as the general reference framework for policies aimed at the development of agriculture, livestock and the rural sector as a whole. It is therefore the new frame of reference for interventions by the State, Development Partners, and all actors operating for the development of the rural sector, in particular national private operators and potentially foreign investors. The development of the rural sector concerns 62% of the population. In this respect, it is considered a national issue.

The strategy is therefore based on the four inseparable components of development:

- The economic component, based on the key sectors of agriculture and livestock, but also on new fields of activity that generate employment in rural areas, such as tourism, ecology or culture;

- The human component, focused on strengthening the capacities of actors to contribute to economic development and respond to the labour market, in particular by ensuring the employability of young people but also of women;
- The environmental component given the urgency of safeguarding, controlling and developing natural resources;
- The institutional component in order to ensure the anchoring of the strategy and therefore its application and sustainability within the functional framework of a new Public-Private Partnership.

7.3.1.2.1. Five strategic axes

Axis 1 – Promotion of the livestock sector

Objective: Promotion of an intensive and competitive livestock sector through the privileged development of animal sectors and the enhancement of extensive livestock farming through the sustainable management of natural resources.

This first axis, which aims to promote the livestock sector, is part of the historical logic of Mauritania's economic and social development.

Axis 2 – Promotion of agriculture

Objective: Promotion of competitive agriculture through the promotion and development of crop sectors with high growth potential

The second axis naturally aims at the promotion of the agricultural sector, which until now has been favoured in previous policies, at least as regards irrigated production and rice production in particular (as the financing mechanism attested). The major feature of this strategy is that it focuses on a balance between four production systems: the "oasis", the "rainwater", the "agro-pastoral" and the "irrigated".

Axis 3 – Local development for competitive agriculture

Objective: Enhanced support for local development to move from subsistence agriculture to competitive livestock and crop production

This strategic axis is based on four observations noted in the various diagnoses: (i) development must be participatory, and involve civil society, in particular the beneficiary target groups, such as young people and women (ii) the development of the rural sector is carried out primarily "locally"; (iii) local populations are dependent on so-called subsistence agriculture, which does not sustainably reduce food insecurity and poverty; and (iv) the need to develop rural innovation and participatory management at the grassroots level, by initiating the local development process, jointly by local elected officials (through communal development plans) and producer organizations (through their action plans by production basin).

Axis 4 – Participatory management of natural resources

Objective: Mastery of natural resource management

The aim is to control the vital resources for the development of agriculture and livestock, such as water and pastures. The prevention of climate change and its consequences, particularly on the use of the resources of the Senegal River, is one of the main objectives of this strategic axis.

Axis 5 – Legal and operational framework appropriate to the efficiency of the strategy

Objective: Good governance and stakeholder accountability

The aim is for the legal and institutional framework to ensure the "effective" implementation of the strategy. Its credibility, vis-à-vis all public and private actors, external partners as well as beneficiaries of civil society, depends on it. There are two reasons for this feasibility: (i) the process of exchange, sharing and consultation has been constantly conducted with regard to the concern to involve the actors at the implementation stage; (ii) the process of developing the strategy to integrate, from its launch, the need to ensure that the strategy is anchored in the country's legal and institutional framework.

7.3.1.2.2. Actors in the implementation of RSDS

The implementation of the strategy, its results and benefits concern the highest authorities of the State and first and foremost the Ministry of Rural Development, which has been split into two ministries (agriculture and livestock) since 2020. The TFPs support its implementation and contribute to its efficiency and effective impact over time. Professionals from the agriculture and livestock sectors, producer organisations, local communities and representatives of civil society (young people in particular) are involved as actors and beneficiaries.

7.3.1.3. National Plans for the Development of Agriculture and Livestock

The National Agricultural Development Plan (NADP) and the National Livestock Development Plan (NLDP) have been designed to implement the guidelines defined by the RSDS adopted as a reference framework for interventions by the State, Development Partners and all actors operating in the context of rural sector development. including domestic private operators and potential foreign investors.

7.3.1.3.1. National Agricultural Development Plan (A) 2016-2025

- **Objectives of the NADP:**

The overall objective of the NADP is to "promote modern, competitive and sustainable agriculture through the development of plant sectors with high growth potential". This objective contributes to the achievement of the overall objectives of the different Strategies (RSDS, NFSS, AGSPS). The specific objectives are based on the strategic orientations adopted and are in line with those of the AGSPS. They are defined as follows:

- Promote the intensification and diversification of agricultural production to meet national needs (by 2025),
- Promote the competitiveness of agricultural sectors,
- Promote the sustainable and participatory management of natural resources,
- Increase the operationality of support structures for the agricultural sector.

- **NADP Strategic Directions:**

For its implementation, the NADP integrates the five (5) strategic orientations (vision 2025) of the RSDS, namely: (i) the maintenance by the Government of its liberalization policy through useful measures to really begin its disengagement in a progressive manner and according to a timetable of accountability of the actors of the sectors, while guaranteeing the sustainability of the sector's activities; (ii) the development of growth-generating sectors, generating permanent jobs and incentive incomes based on structured mechanisms for consultation and effective management of the sectors for the benefit of the actors' organisations, taking into account the "gender" dimension; (iii) the integration of the agricultural sector into the national and international market, (iv) the application of efficient and adapted technological innovations for the intensification and diversification of agricultural production, while remaining respectful of the environment, (v) integrated and participatory development. In addition, the NADP in its design integrates the objectives and initiatives identified as priorities for the development of agriculture and included in the other strategic axes and areas of support of the RSDS. These include the strategic axes concerning (i) local development, (ii) natural resource management and (iii) adaptation of the legal and institutional framework, and the following areas of support: (a) infrastructure support, (b) research, (c) rural advice and training, (d) support for the financing of the agricultural sector.

- **NADP Programs and Sub-Programs:**

The specific objectives are broken down into four main programmes, broken down into sub-programmes, namely:

Table 31: Mauritania's NADP Programs and Sub-Programs

Programs	Routines
Program 1: Intensification and diversification of agricultural production	Sub-program 1.1.: Intensification and diversification of irrigated agricultural production (rice, wheat, horticulture, sugar) Subprogramme 1.2.: Improvement of rainfed production systems for the development of traditional crops (traditional cereals: maize, millet, sorghum) Subprogramme 1.3.: Support for the development of oasis crops (phenonic-growing sector)
Program 2: Promoting the competitiveness of agricultural value chains	Sub-program 2.1: Improvement of storage, processing and packaging infrastructure and equipment, Sub-Program 2.2: Improved Marketing of Agricultural Products Sub-program 2.3: Support for the development of an enabling environment for the competitiveness of the dairy sector Sub-program 2.4: Strengthening the technical, organizational, managerial and negotiation capacities of sector actors
Program 3: Sustainable management of natural resources	Sub-Program 3.1: Improved Land Management, Protection and Rehabilitation of Agricultural Land Sub-program 3.2: Improved Wetland Management and Enhancement
Program 4: Improving the quality of agricultural services	Sub-program 4.1 : Institutional Capacity Building of Agricultural Public Services Sub-Program 4.2: Capacity Building of Producers and their Organizations Sub-program 4.3: Development of financial products adapted to the agriculture sector and development of agricultural insurance systems.

***Source*: NADP 2016-2025**

The overall amount of costs and financing required for the implementation of the NADP from 2016 to 2025 has been estimated at MRU 26.43 billion or USD 831 million. The breakdown of costs shows 19.8% from own funds, 1.9% from contributions from beneficiaries and 79.2% from external financing.

7.3.1.3.2. National Livestock Development Plan (NLDP) 2018-2025

- **Objectives of the NLDP**

The overall objective is the sustainable increase in quality livestock production which is the basis for the livestock sector's contribution to food insecurity reduction, accelerated growth and shared prosperity. As stipulated by the RSDS, the NLDP must promote the development of extensive livestock farming, in particular through the sustainable management of natural resources on the one hand, but also the support of an intensified and competitive sector, through the privileged development of animal sectors on the other hand.

The objectives of the NLDP are part of the livestock sector's orientation towards the achievement of four Sustainable Development Goals (SDGs), namely:

- Eradicate poverty (Goal 1);
- End hunger, achieve food security and improved nutrition and promote sustainable agriculture (Goal 2);
- Establish sustainable consumption and production patterns (Goal 12);
- Conserve, restore and sustainably use terrestrial ecosystems and halt biodiversity loss (Goal 15).

The NLDP, in its formulation and operationalization, must therefore be based on two complementary options and in coherence with the RSDS, which targets all livestock stakeholders, which are:

- Relatively poor pastoralists and small-scale pastoralists who need to be supported by building their capacity;
- Producers and other actors in the value chains that are potentially market-oriented so that they make their investments profitable.

- **Strategic Directions of the NLDP:**

The priority areas of intervention are as follows:

- Axis 1. Support and security of pastoral and traditional livestock farming: which aims to give full importance to pastoral livestock farming in terms of production, and management of natural resources. Pastoral livestock farming, which is highly affected by climate change, must be supported to better cope with hazards and be secured as a fragile mode of production.
- Axis 2. Improving the productivity and competitiveness of promising sectors: which aims to equip public, private and socio-professional actors with all the technical and organisational skills to be more efficient.
- Axis 3. Improvement of veterinary governance: Concerns the control or even eradication of priority animal diseases, in particular transboundary diseases and zoonoses. In addition, the control of risk factors related to the contamination of humans from animals or food products of animal origin.

- Axis 4. Development of applied research, training and advisory support: aimed at increasing animal production, with a view to satisfying national demand and significantly reducing imports. More specifically, the aim will be to improve the sanitary and zootechnical conditions of the herd.
- Axis 5. Strengthening the institutional framework and the capacities of stakeholders: which aims to strengthen the public services responsible for the sector in order to make them more present and efficient in their sovereign mission. Strengthening also consists of supporting the national and foreign private sector in the various animal sectors.

- **NLDP Programs and Sub-Programs:**

Each strategic axis is broken down into an Intervention Programme, which brings together a set of sub-programmes that should ultimately lead to the achievement of one of the expected results of the NLDP. The NESP is structured into five Operational Programmes divided into 17 sub-programmes:

Table 32: Mauritania's NLDP Programs and Sub-Programs

Programs	Routines
Program 1: Development of pastoral and traditional livestock farming	Sub-Program 1.1.: Improved Management of Pastoral Resources Subprogramme 1.2: Support to pastoralists and small-scale pastoralists Sub-program 1.3.: Development of traditional (family) poultry farming
Program 2: Development of animal supply chains	Sub-Program 2.1: Live Livestock Enhancement and Red Meat Production Sub-Program 2.2: Harvesting By-Product Recovery: Hides, Horns, Hoofs Sub-Program 2.3: Dairy Sector Development Sub-Program 2.4: Poultry Sector Development Sub-Program 2.5: Forage Development and Concentrated Feed Production
Program 3: Improving animal health and veterinary public health	Sub-program 3.1: Capacity building of veterinary services (technical governance, diagnostics, epidemiological surveillance) Sub-Program 3.2: Improved Veterinary Public Health Sub-Program 3.3: Improved Immunization Coverage for Priority Diseases
Program 4: Capacity building for research and development, training and mentoring	Sub-Program 4.1 : National Breeding Program Development Sub-programme 4.2: Livestock Services Advisory Support Capacity Building and Technical and Professional Capacity Building Sub-Program 4.3: Establishment of an Applied Veterinary and Zootechnical Research Program
Program 5: Institutional Capacity Building of Stakeholders	Sub-program 5.1: Strengthening the intervention capacities of the structures of the Ministry of Livestock Sub-programme 5.2: Capacity Building of Women Livestock Professionals Sub-program 5.3: General livestock census and information system

Source: NLDP 2018-2025

The total cost of the NLDP programmes over the period 2018-2025 is estimated at: 11.24 billion ouguiyas divided between the State and technical and financial partners (TFPs) for 38% and 62% respectively.

7.3.2. Environmental strategies

Introduction

The adoption in 2007 by the Government of the National Strategy for Sustainable Development (NSSD) and subsequently its two National Environmental Action Plans: NEAP1 (2007-2011) and NEAP2 (2012-2016) provided a clear guiding framework to introduce the necessary changes in the initial mode of environmental management and: (i) federate the efforts already made in terms of sustainable environmental management, through the strengthening of the new institutional framework for coordination and adequate monitoring and (ii) initiate priority actions as defined in NEAP 2.

Mauritania's NEAP 2 was fully aligned with the various reference planning frameworks considered at the national level, and more specifically with the Poverty Reduction Strategy Paper (PRSP) in its third generation, as well as with the various multilateral environmental agreements, including the UNCCD, the UNFCCC and the CBD.

The NSSD and NEAP2 expired in 2016. The development of the National Environment and Sustainable Development Strategy(NESDS) and its Operational Plan was therefore necessary to take into account environmental trends and issues. The NSEWS should not be seen as just another strategy, but as a framework for coherence and synergy between sectoral programmes, plans and policies with a view to sustainability and the spirit of participation of all. It must thus outline a social project, a promising future for Mauritania, respectful of the value of its territories, its natural and cultural heritage, the aspirations of its youth and the rights of its future generations. To this end, the NSEWS must: – be in line with international best practices, and take up, on the basis of an updated and refined analysis, the challenges that Mauritania faces and to which it is committed in terms of sustainable development; – integrate the principles of the framework law on the environment, promote the guiding principles of the other policy frameworks as well as the major principles of sustainable development; – present an ongoing process of engagement of different stakeholders to achieve common goals that contribute to addressing key sustainability issues; – be part of the development choices made, in particular through the AGSPS, and build on or integrate the strategies, plans and programmes currently being implemented, defined in particular within the framework of the country's sectoral policies.

7.3.2.1. National Environment and Sustainable Development Strategy (NESDS) 2017-2021, Horizon 2030

In line with the AGSPS and the MESD Guidance Letter, the NESDS aims to sustainably strengthen the resilience of natural systems and people's livelihoods while supporting an investment policy, low-carbon activities that promote pro-poor economic growth, and preserving the living environment through effective governance.

7.3.2.1.1. Objectives and strategic axes

- **Objectives of NESDS**

The overall objective of the NSEDS by 2030 is therefore not only to slow environmental degradation, but to reverse degradation trends so that the development of natural resources contributes effectively to ensuring green and inclusive growth.

The specific objectives of the NESDS are:

- Valuing natural resources in a sustainable and resilient way for the benefit of the poor ;
- Promote the environmentally sound use of ecosystem services and natural resources.

- **NESDS Strategic Focus**

The NESDS is structured around four strategic axes that take into account the complexity of ecosystems and their interrelationships with human activities and global governance:

i. Axis 1: Integrated and responsive environmental governance

This axis overlaps with the main SDGs: 16, 8, 12, 13, 5. The aim is to adopt a policy based on an integrated approach to the conservation, management and sustainable use of terrestrial and marine ecosystems on the one hand, and to mitigate the environmental risk associated with anthropogenic activities.

ii. Axis 2: Integrated and sustainable management of natural resources and terrestrial biodiversity ('green' environment)

This axis intersects with core SDGs 2, 5, 6, 13, 15 and 16. Mauritania is one of the countries most exposed to the effects of desertification, droughts and climate change, as mentioned above. These effects have major consequences for productive capacity and ecological heritage. This raises questions about the management of terrestrial natural resources, but also the resilience of communities, particularly the most vulnerable. This axis aims to promote integrated and sustainable management of terrestrial natural resources. The aim is to enhance natural capital and exploit ecological opportunities with a view to sustainability and resource protection.

iii. Axis 3: Sustainable management of the marine and coastal environment ('blue' environment)

This strategic focus intersects with the main SDGs 1, 6, 11, 12, 13, and 14. It concerns a central issue for development. The large ecosystem complex of marine spaces and coastlines is the main hub of socio-economic activities in Mauritania. The sustainable development of marine resources and the protection of the marine environment are essential for the preservation of fisheries potential. The marine and coastal environment is exposed to numerous threats related to climate change, economic activities and urbanization, as well as the risks of overexploitation of resources accompanying fishing activities that focus mainly on the most valuable species.

iv. Axis 4: Strengthening the prevention and management of pollution and anthropogenic threats ('grey' environment)

This axis intersects with core SDGs 6, 7, 9, 11 and 12. The Mauritanian population has rapidly transitioned from being agro-pastoral nomads to a predominantly urban population. This has led to a significant development of urban centres and an in-depth overhaul of productive sectors. The aim is to strengthen actions to manage and

limit urban and industrial pollution, mitigate emissions and develop a capacity to respond to the risks of entropic disasters.

These four axes encompass all horizontal issues related to the management of the environment and the management of its various aspects in the different sectors that influence the state of natural resources and the environment in general. Three areas are devoted to the preservation and enhancement of natural resources as well as to the management of environmental risks, particularly in urban areas, the second area of environmental intervention of the AGSPS.

7.3.2.1.2. National Environment and Sustainable Development Action Plan (NESDAP) 2017-2021

To implement the actions planned by the NESDS, the NESDAP was developed in 2017 but has not yet been updated for the current period.

The activities planned by NESDAP are linked to 16 thematic axes that stem from the strategic axes set out by NESDS.

Table 33: Mauritania's Areas of intervention of the NESDAP

Strategic focus	Thematic focus
Strategic Axis 1: Integrated and responsive environmental governance	Thematic axis 1.1. Cross-sectoral coordination/synergies and partnerships for the effective implementation of Environment and Sustainable Development policy Thematic axis 1.2. Sustainable Financing for Environmental Action Thematic axis 1.3. Environmental Information, Education and Communication (IEC) and Capacity Building Thematic axis 1.4. Organisation/Institutional Reform Thematic axis 1.5. Knowledge Management (Research, Environmental Information Systems and Monitoring) for Decision-Making Thematic axis 1.6. Regulatory, normative and supervisory framework
Strategic Axis 2: Sustainable management of natural resources and biodiversity ('green' environment)	Thematic axis 2.1. Management and sustainable development of terrestrial natural resources by integrating the CC Thematic axis 2.2. Local and collaborative management of natural resources Thematic axis 2.3. Protection of animal and plant biodiversity
Strategic axis 3: Sustainable management of the marine and coastal environment ('blue' environment)	Thematic axis 3.1. Regularization of uses and sustainable enhancement of coastlines and marine spaces, taking into account the CC Thematic axis 3.2. Concerted management/execution and effective coordination between all actors (MPAs, coastal PAs, fisheries, coastal occupation, maritime and land transport, hydrocarbons, mines, cities, etc.) Thematic axis 3.3. Restoration of ecosystems that provide protection against shoreline erosion Thematic axis 3.4. Physical protection of the coastline (especially Nouakchott) against the effects of CC
Strategic axis 4: Strengthening the prevention and management of pollution and anthropogenic threats ('grey' environment)	Thematic axis 4.1. Waste and pollution management Thematic axis 4.2. Reduction of emissions/pollution Thematic axis 4.3. Disaster Risk Reduction

Source: NIEDD 2017

The total budget required for the implementation of NESDAP is estimated at MRU 1.56 billion, or about USD 49 million at the level of the Ministry of Environment and Sustainable Development. In addition to this envelope,

the budget of the ANGMV, estimated at MRU 3.98 billion or USD 125.13 million, which is attached to the MESD, but must mobilize the funds largely from its own means. The operational implementation of NESDAP and its financing is everyone's responsibility and involves all stakeholders. Given the cross-cutting nature of environment, sustainable development and climate change involving all sectors to varying degrees, the programmes of several other ministries are directly linked and contribute to the implementation of NESDAP. They directly finance and implement part of the NESDAP. However, the cross-cutting nature of the environmental dimension does not make it possible to distinguish precisely the part of the budget allocated to the environment dimension, sustainable development and climate change in the national strategies and action plans of the other Ministries.

7.3.2.2. National Wetland Conservation Strategy (NWCS) 2014

The National Strategy for the Conservation, Restoration and Sustainable Management of Wetlands is based on the principle of sustainable use of natural resources and equitable sharing of roles, responsibilities and benefits. It follows an integrated, multi-sectoral and ecosystem-based participatory approach. Its priorities are wetland restoration, biodiversity conservation, environmental protection, sustainable use of wetland ecosystems, protection of wetlands against silting up, and improvement of the living conditions and environment of present and future generations with a view to sustainable development of Mauritania.

7.3.2.2.1. Issues

Unsustainable use of wetlands inevitably leads to the waste of natural resources, the destruction of vegetation cover and the reduction of the current wetland area. This overexploitation has sparked interest in the conservation and rational management of these ecosystems at the local, national and international levels. Therefore, it is imperative to define how and how sustainable management can be managed in a way that corresponds to ecological and socio-economic needs and constraints, and that is adapted to local circumstances. However, this management cannot be fully developed and implemented at the local level without the collaboration of local communities, legislators and experienced professionals.

The challenge is therefore to get decision-makers and all stakeholders to:

- Understand the importance, vulnerability and complexity of the process of wetland biodiversity degradation;
- Clearly identify and assess the direct and indirect root causes of wetland degradation;
- Develop, adopt and implement in a participatory and consensual manner appropriate mechanisms for the conservation, restoration, sustainable use and equitable sharing of wetland biodiversity and associated ecosystems through effective partnerships.

On the other hand, the conservation of wetlands and associated ecosystems and the maintenance of the ecological stability of these ecosystems require complementary actions in the context of the elaboration of integrated land use and development plans.

7.3.2.2.2. Challenges

By developing a national strategy for the conservation of wetlands while taking into account the main issues, Mauritania expresses its desire to promote the conservation and sustainable management of wetlands with the major challenge of maintaining all the functions of wetlands and improving the conditions and living environment of local populations. To be successful, this new sustainable development policy must take into account economic, social and environmental considerations. The Mauritanian government hopes that this development model will contribute to reducing poverty without depleting the natural resources needed for future development.

7.3.2.2.3. Main threats to wetlands

The main threats to wetlands and terrestrial ecosystems are: Overgrazing; Overexploitation of forest and non-timber products; Habitat fragmentation; Poaching; Climate Change; Bushfire; Urbanization; Salinization; Erosion; Introduction of non-native species; Mining & Petroleum; Pollution.

7.3.2.2.4. Purpose of the NWCS

The aim of this strategy is to conserve, restore and sustainably use wetlands and their associated biodiversity. This is in order to improve the living conditions and environment of the local populations, and to guarantee future generations sufficient natural resources for the sustainable development of the country.

7.3.2.2.5. Strategic axes

The implementation of the NWCS's objectives is reflected in areas of intervention. These axes can be cited as follows:

- Strategic axis 1 : Establish a governance system
- Strategic axis 2 : Establish a specific legal framework for wetlands
- Strategic axis 3: Preserve and restore wetlands
- Strategic axis 4 : Regulating access to wetland resources
- Strategic Axis 5 : Improving Watershed Management and Development
- Strategic axis 6 : Developing sustainable crop and livestock practices in wetlands
- Strategic axis 7 : Animate and implement the wetland conservation strategy
- Strategic axis 8 : Strengthening institutional and human capacities
- Strategic axis 9 : Strengthening technical and scientific capacities
- Strategic axis 10 : Promoting sustainable technologies for the exploitation of natural resources
- Strategic axis 11: Develop income-generating activities compatible with the sustainable management of wetlands
- Strategic axis 12 : Establishing a sustainable financing mechanism

7.3.2.2.6. NWCS action plan

The implementation of the NWCS integrates existing and/or start-up activities and initiatives. At the level of the local population, several actions are being carried out. For reasons of complementarity, the action plan must include all initiatives that are consistent with the provisions of the Poverty Reduction Strategy Paper (PRSP),

the National Biodiversity Strategy (NBS) and the National Adaptation Program (NAP). This plan is structured into 12 programmes spread over several actions:

Table 34: Mauritania's NWCS's priority actions

Strategic focus	Main actions
Strategic Axis 1: Establish a governance system	Mapping wetland uses and users Mapping the actors Establish governance bodies at local, regional and national levels Establish co-management systems for each significant wetland
Strategic Axis 2: Establishing a wetland-specific legal framework	Integrate wetland conservation and sustainable use concerns into the sectoral legal corpus Drafting new texts to fill the legal gap in the various sectors
Strategic axis 3: Preserving and restoring wetlands	Halting the process of wetland degradation Restore wetlands to improve ecological continuity.
Strategic axis 4: Regulating access to wetland resources	Develop plans for the development and management of wetlands of national and international importance Setting rules for access to wetland resources
Strategic Axis 5: Improving watershed management and management	Draw up a list of the uses and users of each watershed Develop watershed management plans Create Watershed Associations Implement watershed management plans
Strategic axis 6: Developing sustainable wetland farming and livestock practices	Promote agricultural practices aimed at limiting and/or avoiding land clearing Promoting agricultural products resulting from wetland preservation processes Promoting intensive livestock farming and animal breeding Setting the rules for the sustainable use of pastoral wetland resources
Strategic axis 7: Leading and implementing the wetland conservation strategy	Setting up an information system Development of tools for sustainable wetland management Establish a dashboard on the wetland conservation strategy Promoting the teaching of environmental education Publish, disseminate and popularize information related to the sustainable management of wetlands;
Strategic Axis 8: Strengthening institutional and human capacities	Strengthening the capacity of technical services responsible for wetland management Creating local frameworks for consultation Strengthen stakeholders' wetland and environmental management capacities; Establish specific mechanisms for the promotion of local know-how.
Strategic Axis 9: Building technical and scientific capacity	Continue botanical and ecological inventories in wetlands to provide information on their floristic richness, dynamics and functioning Conduct socio-economic studies to determine the use and use of wetlands and their importance to local populations Carry out wildlife and fish surveys in wetlands to identify priority species for the conservation of mangrove biodiversity (rare, endemic, threatened or endangered species) Conduct research on endangered species, their dynamics and the functioning of their biotopes Promote specialized training programs necessary to carry out these various studies Promote research, identification and acquisition of appropriate and adapted technologies for the conservation, restoration, and sustainable management of wetlands.
Strategic Axis 10: Promoting sustainable techniques for the exploitation of natural resources	Optimize local control of, and access to, natural resources through participatory mechanisms; Provide support and incentives for community-based forms of use and management of natural resources that ensure long-term sustainability; Promote the transfer of technologies for the sustainable management of natural resources and environmental protection to the pro-poor; Promote local know-how to ensure sustainable use of wetland resources

Strategic Axis 11: Develop income-generating activities compatible with sustainable wetland management	Promote alternative income-generating activities and local initiatives that can help local communities at the grassroots level to improve their living conditions in order to reduce the pressures they exert on natural resources - Facilitate access to credit, appropriate technologies and equipment for populations living near wetlands
Strategic Axis 12: Setting up a sustainable financing mechanism	Conduct a study on the establishment of a sustainable financing mechanism Train stakeholders on project formulation, - Develop a portfolio of projects Organize a donor roundtable

Source: NWCS 2014

The total necessary budget for the implementation of the NWCS action plan is estimated at 357.5 million MRU, or about 1.12 million USD at the level of the Ministry of Environment and Sustainable Development.

The responsibility for the implementation of the Action Plan rests with all the various local stakeholders (farmers' organizations, local elected officials, local populations), national (State, technical services, civil society), non-governmental (NGOs) and international (cooperation partners, donors, international NGOs).

7.3.2.3. National Determined Contribution (NDC) 2021-2030

Mauritania has been among the Sahelian countries most affected by recurrent droughts since 1968. The resulting desertification is all the more pronounced because the effect of the climate, combined with the action of man, has direct consequences on an already very precarious environment. The country's vulnerability to climate change affects all vital sectors of the national economy.

By ratifying the UNFCCC, Mauritania is resolutely committed to the global process of combating global warming by limiting GHG emissions and implementing adaptation strategies compatible with its sustainable development policy. It reaffirms this commitment by ratifying the Paris Agreement and submits its first Nationally Determined Contribution (NDC) in 2015.Although the country's emissions constitute barely 0.015% of global emissions, Mauritania commits through its NDC to participate fully in the international community's effort, by making available, in conditional form, a mitigation potential of approximately 33.56 million tonnes of CO2e. i.e. 22.3% compared to the projected emissions in the same year, according to the reference scenario (normal course of business), during the period 2020-2030. In 2015, the process of drafting the NDC took place at a time when the country was changing its strategic development vision from the Poverty Reduction Strategy Paper (CLSP, 2001-2015) to the National Strategy for Accelerated Growth and Shared Prosperity (AGSPS), whose first five-year action plan covers the period from 2016 to 2020. In 2021, and in line with the five-year cycle of updating NDCs promoted by the Paris Agreement (PA), Mauritania is updating its NDC at the same time as it is taking stock of the first five-year implementation plan of the AGSPS which led to the definition of the second five-year plan 2021-2025. The concomitance of the two processes, AGSPS and NDC, ensures coherence between the two policy frameworks and synergy of the programmes enshrined in them.

The overall cost of the updated NDC is estimated at US$46,561 million, of which US$1,132 million is unconditional. In Mauritania, there is no financing system specifically dedicated to climate change. The MESD has developed several skills in mobilizing climate finance from specific international funds (Green Climate Fund, Adaptation Fund, Multilateral Development Bank funds, etc.) and TFPs.

7.3.2.3.1. Mitigation ambitions of the updated NDC

Mauritania's updated NDC foresees an economy-wide net reduction in GHG emissions of 11% in 2030 (green curve) compared to the baseline scenario (BAU, blue curve) with the country's own resources supported by international support comparable to that received until 2020. With more support, Mauritania could ensure the carbon neutrality of its economy, by achieving a 92% reduction (red curve) compared to the BAU. The overall cost of this ambition is estimated at US$34,255 million, of which US$635 million is unconditional, i.e. 1.85%. The mitigation ambition covers all four emission sectors (Energy, IPPUP, AFOLU and Waste). The most important mitigation efforts are based on the country's significant renewable energy potential and the capacities to increase the share of clean energy in the energy mix to reach more than 13 GW renewable in 2030 but also of the AFOLU sector with a forestry-focused potential through ambitious projects and programs (Great Green Wall, programmes for enhanced forest regeneration, rangeland regeneration and combating desertification), agroecology and improving livestock productivity.

The country's mitigation ambition is composed of a total of 55 measures, including 33 unconditional measures with a total capacity of 1834.268 Gg CO2 eq compared to the normal course of business (BAU) scenario and 22 conditional measures for a reduction in 2030 of 16134.62 Gg Eq. CO2 representing a 92% reduction compared to BAU. These measurements are shown in the below Figure:

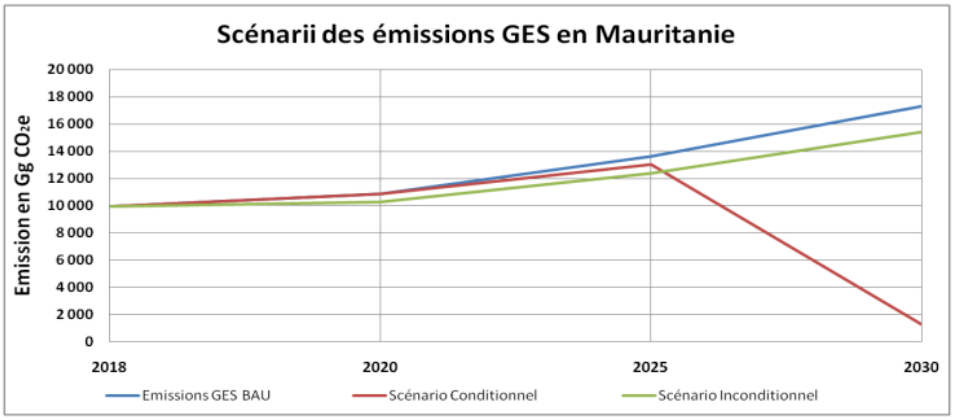


Figure 21: Scenarios of GHG emissions in Mauritania.

Source: MESD, updated NDC 2021-2030

7.3.2.3.2. Adaptation actions called for by the updated NDC

Mauritania has been extremely vulnerable and has broadened its adaptation ambition to cover the following areas: protection and conservation of ecosystems including wetlands, rangeland management, biodiversity conservation, fisheries and aquaculture, housing and urban planning, food security including genetic improvement, health, infrastructure, education, and prevention of extreme weather events. This expansion is based on the Green Climate Fund Access Readiness Program and the results of the first studies carried out as part of the country's National Adaptation Program (NAP) development process. The financing needs for adaptation measures are $USD 10,626.46 million, of which $US 10,174.63 million are conditional and $US 451.83 million are unconditional. To address the challenges of mainstreaming climate change into sectoral strategies and policies, the implementation of identified adaptation actions needs to be planned through a cross-sectoral and integrated approach that includes all relevant stakeholders and sectors. To this end, the 2021-

2030 NDC must serve as a framework for consultation and dialogue to define transformative programmes that meet the needs of strengthening the resilience of populations and ecosystems with regard to their vulnerability to climate change.

7.3.2.3.3. Capacity-building needs and implementation support

In addition to the financial support expressed as conditional support for mitigation and adaptation actions, the NDC 2021-2030 defines needs for capacity building, technology transfer and training, particularly for youth education. In terms of capacity building, the establishment of an operational measurement, verification and reporting (MRV) system is a priority action in the process of implementing the UNFCCC and the Paris Agreement. The implementation of this system is mandatory for the country (deadline 2024 for the submission of the biannual transparency report - BTR intial). In addition, and although non-binding for the country, the development of an action plan for the implementation of the NDC is a prerequisite for MNV/MRV.

Technology transfer needs assessments were completed in 2017. They led to the identification of two priority sectors for adaptation (agriculture, rangeland and forestry) and two priority sectors for mitigation (energy and waste). They will need to be updated in light of the new mitigation and adaptation options identified in the updated 2021-2030 NDC

7.3.3. Key climate change adaptation measures adopted

Mauritania's updated Nationally Determined Contribution (NDC), for the period 2021-2030, foresees a net economy-wide reduction in greenhouse gas emissions of 11% in 2030 compared to the baseline scenario with the country's own resources supported by international support comparable to that received until 2020. With more support, Mauritania could achieve carbon neutrality, up to a conditional 92% reduction compared to BAU. In view of its extreme vulnerability, Mauritania has broadened its adaptation ambition to cover the following areas: protection and conservation of ecosystems including wetlands, sustainable rangeland management, biodiversity conservation, fisheries and aquaculture, housing and urban planning, agriculture and food security including genetic improvement, health, water, coastal management, prevention of extreme weather events, infrastructure and education. This expansion is based on the Green Climate Fund Access Readiness Program and the results of the first studies carried out as part of the ongoing process of developing the country's National Adaptation Program (NAP). It should also be noted that Mauritania, along with 10 other African countries, is fully committed to the Great Green Wall project. This large-scale project consists of combating desertification by planting a vegetative belt more than 8000 km long, stretching from Senegal to Djibouti.

Based on these priorities, adaptation actions have been identified by the updated NDC and are described in the below Table. Although categorized by sector, their implementation is planned from an interdisciplinary and intersectoral perspective that intersects with the vulnerabilities of different sectors.

Table 35: Adaptation actions to the CC by 2030 in Mauritania

Sectors	Climatic hazards/ Projections	Vulnerabilities/ Impacts	Adaptation actions
Resources Natural	More frequent and severe droughts	•Desertification • Land, forest and rangeland degradation	• Management and creation of classified forests (20 forests) • Aerial seeding (150,000 ha)

	Disruption of the rainy season Temperature increase Sandstorms and dust Severer intense rainfall	• Wildlife Loss / Biodiversity • Draining of wetlands	• Wetland development and management through the Wetland-based Adaptation (Weltland) approach (10 Wetland) • Reforestation 3,000 ha/year • Great Green Wall programme: 10,000ha (i.e. 2000 ha/year for 5 years)
Agriculture	More frequent and severe droughts Disruption of the rainy season Sandstorms and dust Temperature increase Severer intense rainfall	• Decreased soil fertility • Lowering of the water table in oases • Loss of soil fertility and loss • Proliferation of crop pests (sesamia, etc.) •Rural exodus • Food insecurity	• Establishment of a climate risk insurance system • Development of organic agriculture / agroecology (6000 ha)
Breeding	More frequent and severe droughts Temperature increase	• Overgrazing and reduction of pastoral land • Decreased pastoral productivity • Deterioration of animal health • Decline in pastoralists' incomes/Rural exodus	• Creation of new artificial insemination farms (at least 20 farms) • Establishment of pastoral reserves (20,000 ha)

Source: MESD, updated NDC 2021-2030

Adaptation techniques are being developed and their improvement will allow the promotion of three-storey crops in oasis areas (agroecological practice) which will contribute to consolidating the resilience of ecosystems. These include water and soil conservation and soil defence and restoration schemes (SWC/SDR) that improve the natural recharge of the water table, as well as actions to combat silting and reduce evapotranspiration.

7.3.4. The main measures adopted to preserve natural resources

Mauritania is one of the countries most exposed to the effects of desertification, droughts and climate change. These effects have major consequences on productive capacity, ecological heritage and natural resources due to poverty and shrinking productive areas. This raises serious problems and questions about the management of terrestrial natural resources, their sustainability but also the resilience of communities. However, the country has a lot of natural potential and ecological opportunities that must be fully exploited for the benefit of environmental protection and sustainable development.

Strategic axis 2 of the NESDS focuses on the integrated and sustainable management of natural resources and terrestrial biodiversity:

7.3.4.1. Management and sustainable development of terrestrial natural resources by integrating the CC

The protection and rehabilitation of natural resources in the terrestrial environment is a concern for the development of the rural world and the stabilization of the population in their territory. The activities of this axis revolve around agropastoral and hydraulic themes and take into account a major fundamental issue, which is

that of the effects of climate change. The main sub-themes are (i) the fight against desertification and the resilience of agro-pastoral systems, (ii) the reasonable and integrated management of water resources, (iii) the management/exploitation of wood resources and energy-wood, (iv) the creation of jobs and rural incomes through the sustainable development of NTFPs, agroforestry and animal by-products, with a focus on women's groups and (v) the development and sustainable development of inland fisheries.

7.3.4.2. Local, decentralised and collaborative management of natural resources

The sharing of responsibilities and the active participation of the population in the management of natural resources are fundamental to the successful implementation of an integrated environmental policy on the ground. This axis aims to strengthen and promote more decentralised and participatory modes of operation for the local management of natural resources. The aim is to promote and scale up the DRM (Decentralized Management of Natural Resources) approach and to strengthen the capacities of all actors as well as local consultation mechanisms.

7.3.4.3. Protection of animal and plant biodiversity

Securing and rehabilitating existing biotopes of high ecological value are essential to preserve the functioning of ecosystems and to respect Mauritania's environmental commitments at the international level. The aim is to promote the effective management and extension of terrestrial Protected Areas, to strengthen the protection of natural flora and fauna and to rehabilitate degraded ecosystems of high ecological value.

7.3.5. The main guidelines for research and training, the indicators and their shortcomings

7.3.5.1. The main orientations in the field of research and training

The National Agricultural Research Plan 1995-2004, which defines important research programmes for the country's main agro-ecological zones, has not been implemented. Nevertheless, it has made it possible to establish the following strengths for agricultural research: (i) significant achievements in the irrigated system for which research stations and equipped laboratories have been set up; (ii) membership in an international and regional network of scientific and technical institutes and organizations; (iii) national rural development programmes supported by international and national NGOs; (iv) structures for the production of pre-basic seeds and fruit plants. The RSDS provided guidance for agricultural research over the period 2013-2015.

7.3.5.1.1. Overall Objective

The overall objective is to develop, promote and ensure the competitiveness of promising agricultural value chains in all agro-ecological zones and in all dominant production systems.

To achieve this objective, research must:

- 1. Carry out an inventory and evaluation of agricultural research achievements at the national, sub-regional and international levels on the main sectors identified as promising in Mauritania (agriculture and livestock) and according to participatory methods;
- 2. Identify and evaluate, in a participatory manner, the demand for research and the needs for innovations, by sector and by production system;
- 3. Identify and evaluate the physical (laboratories, research stations, equipment, materials, etc.), financial and human resources of the national agricultural research system;
- 4. Evaluate and update the national agricultural research plan that meets the needs of the sectors;
- 5. Define research programmes, by production basin and in close collaboration with the Competitiveness Clusters;
- 6. Introduce and implement itineraries and techno-economic benchmarks aimed at improving the intensification and diversification of the production of the sectors while promoting the knowledge and know-how of the actors of the sectors;
- 7. Introduce and develop appropriate and efficient technologies for the promotion of small family farms;
- 8. Introduce and adapt new technologies aimed at improving the competitiveness of the agriculture and agri-food sectors.

7.3.5.1.2. Specific Objectives

In terms of agricultural research, there are 6 specific objectives for the period 2013-2015:

Objective 1 - Inventory and participatory evaluation of research achievements.

These include achievements concerning:

- Date palm in Kankossa (phytotechnics and date palm adaptation tests), and in Atar (biological control of Parlatoria Blanchardi cochineal, date packaging and use of by-products);
- Cereals and food legumes in rainfed and flood recession crops, within the framework of the Mauritania-Senegal-French Institute for Research in Tropical Agronomy (IRTA) tripartite agreement;
- Irrigated rice cultivation with water management, in cooperation (technical and financial) with the UNDP Association for the Development of Rice Cultivation in West Africa (WARDA, now Africa Rice), FAO, CIRAD and CORAF (Irrigated Systems Clusters);
- Fruit and vegetable crops, with the support of the French Aid and Cooperation Fund (FAC) and the FAO;
- Cereal diversification (maize, wheat, sorghum, triticale) which has allowed Mauritanian agriculture to experience a real boom, particularly in the predominantly irrigated production system.

Objective 2 – Identification and evaluation of the research request

At the national level, the aim is to establish a national agricultural and agri-food system that draws on all the skills and institutions capable of developing and sustainably supporting research that listens to its customers, and is concerned both with preserving basic natural resources and ensuring the sustainability and competitiveness of promising agricultural sectors.

At the regional level, the focus is on adaptive research, introducing new technologies that have proven successful in regions with proven agro-ecological and socio-economic similarities with local production systems.

At the local level, efforts are focused on the definition and implementation, participatory monitoring and evaluation of research and development that listens to all stakeholders in the value chains, and in all agro-ecological zones.

Objective 3 – Resource Identification and Assessment

These are the physical, human and financial resources of the national agricultural research system. To enable it to achieve its objectives of supporting the development and competitiveness of promising sectors, agricultural research must:

- 1. Strengthen its capacities by: the inventory of human resources that can be mobilized at the level of the National Agricultural Research System ; recruitment of research staff at the subregional and international levels; the use of bilateral and multilateral technical assistance and the training of national researchers and research personnel; the development of an attractive and secure status for researchers and research personnel; and the definition of training plans for researchers, taking into account the needs and priorities of the promising sectors, will be carried out;
- 2. Consolidate, rehabilitate and develop infrastructures (research stations and substations, laboratories), equipment and professional materials;
- 3. Identify sources and mechanisms of funding for research, involving public actors, private actors and those of civil society (NGOs in particular). The establishment of a national/regional or local research fund to finance research programmes through "calls for proposals" will be studied.

The consolidation of the scientific and technical research base requires strengthening the capacities of Rosso's research stations to support the rice sector and benefit from the local scientific and technical environment (and in particular Higher Institut of Technical Studies-HITS, which has about twenty laboratories and a dozen high-level researchers) and sub-regional (Africa Rice, the Senegal Sugar Company, which has a high-performance soil science laboratory and a plant breeding laboratory; the regional directorate of the Senegalese Institute of Agricultural Research based in Saint Louis; of Kaedi for Agricultural Diversification and that of Atar, which has a major research laboratory on date palm pests).

Objective 4 - Definition of programmes by production area

The definition of this programme is carried out in close collaboration with the competitiveness cluster. Technical standards relating in particular to plant breeding, plant farming, crop and crop protection, soil science, fertilisation and soil fertility management, mechanisation (small, intermediate and heavy), water saving (dewatering systems and irrigation efficiency), rural economics and sociology (working time, reproduction of the labour force, etc.). production costs, crop intensity, decision-making tools), agri-food (food processing, preservation, engineering and hygiene) are developed using a participatory approach to meet the priority needs of the agricultural and agri-food sectors identified by the actors at the grassroots level.

Objective 5 - Routes and techno-economic benchmarks

In the various agro-ecological zones, the research offer aims to develop the following sectors:

- cereals (rice, wheat, maize, sorghum, millet, fonio);
- Food and protein legumes (cowpeas, peanuts and berets or freshwater watermelon);
- Market gardeners (onion, potato, sweet potato, tomato, turnip, carrot and eggplant);
- Fruit trees (dates, bananas, mangoes, limes);
- Agro-forestry (gum arabic, jujube, baobab fruit or monkey bread);
- Agro-industrial (sugar cane, sunflower, jatropha);
- Forage (fodder cowpeas, peapeas, pigeon peas, pennHITSum purpereum, panicum maximum, alfalfa alfalfa, fodder maize);
- Seeds and seedlings, with a particular focus on the production of quality and quantity (in order to cover demand) of pre-basic seeds and August grafts. Technical and economic itineraries and benchmarks are drawn up by sector and production basins.

Objective 6 - Evaluation of the National Agricultural Research Plan (NARP)

A National Agricultural Research Plan (NARP) drawn up in 1995 and covering the period 1995-2004, was financed by the World Bank, within the framework of the Agricultural Services Project (ASP), which was terminated prematurely. This NARP analysed the relevant research findings by agro-ecological zone and dominant production system. The updating of this plan for 2013–2025 is justified by the adoption of the value chain approach as a gateway to agricultural development, by the need to take into account new research demands identified through a participatory and bottom-up approach, and by the involvement of wetlands and maritime areas in the new agrarian landscape covered by promising agricultural sectors. The identification and mobilization of research personnel and the definition of training needs for the technical skills necessary for the implementation of the new National Plan for Agricultural and Agri-Food Research are ensured to meet the research demand of actors in priority sectors.

7.3.5.1.3. Research Status

The Mauritanian institutions in charge of agricultural research are: (i) the National Centre for Agricultural Research and Agricultural Development (NCARAD), which is responsible for research focusing primarily on crop production and its technical environment, and (ii) the Higher Institute of Technical Studies (HITS).

The NCARAD has 10 research stations whose main support activities are: (i) the production of fruit plants, (ii) the support of the Department in various development programs, namely: the program for the production of pre-basic wheat seeds and the program for the development of fodder crops in N'Beikitt Lahwach.

The weak points are: (i) the absence of a specific status of the researcher (lack of motivation) which has led to the departure of almost all the technical staff. The NCARAD does not have a plan for the succession of researchers and assistants, (ii) the advanced degradation of some research stations, (iii) the non-functionality of laboratories such as the soil science laboratory, the crop protection laboratory (entomology and phytopathology) and the plant breeding laboratory in addition to the absence of a conservation cold room, as well as the weakness of the financial resources allocated by the State. All these factors combined make it difficult for this "pillar" institution to carry out its mission.

From 2010 to 2016, the subsidies granted by the State to the NCARAD budget increased from 9,175,750 MRU in 2010 to 15,754,300 MRU in 2016, i.e. about 230 to 400 thousand USD. Thus, the low level of State support for the NCARAD, which is used for nearly 85% to pay the salaries of a large number of staff often not needed for research activities, does not allow reliable and sustainable research activities to be undertaken. In addition, it should be noted:

- The timid integration of research into the agricultural sector and the socio-economic reality;
- Insufficient coordination links between research and other development actors, including MA projects;
- The scarcity of external financing.

Despite the efforts made and the achievements made, particularly in the irrigated system and the approach based on Research & Development in partnership with international and regional organizations for scientific and technical cooperation (AfricaRice, ICARDA, etc.)

However, an articulation between research/extension/producer organization and other actors such as the private sector, consumers and traders makes it possible to:

- Develop demand-driven research while taking into account all agricultural research skills;
- Promote better uptake and dissemination of what has been learned in terms of improved technologies.

Also, a career planning policy for managers would strengthen the sense of security of research staff and contribute to their retention. In this way, any executive involved in research will be able to receive a salary that corresponds to his or her skills and experience without necessarily having to aspire to any job title. Finally, the proposed technical innovations must be responses to farmers' problems based on diagnosis and identification of constraints limiting agricultural development and production, while taking into account aspects related to climate change.

7.3.5.1.4. Formation

Capacity-building has always been a key part of development policies and strategies in Mauritania, including in the rural sector, where modernization activities increasingly require qualified personnel with a wide range of technical know-how to ensure the proper conduct of the production process. Indeed, the skills required for the development of farms must cover all rural development sectors (agriculture, livestock, forestry, agricultural crafts, agricultural industry, etc.).

In order to meet the needs of the rural sector in terms of skills and competences, several vocational training structures have been set up by the State. These are mainly attached to the Ministry of Rural Development, which has recently been split into two departments, the Ministry of Agriculture and the Ministry of Livestock.

These are mainly:

- The National Training and Extension School of Kaedi (NSATE) was created in 1972 with the support of UNDP and FAO and has recently been revitalized after a few years of cessation of

activity. Since its creation, NSATE has trained a significant number of executives in the fields of rural economy, agriculture and livestock;

- The Training Center for Rural Producers of Boghé (TCRPB) was set up in 1973 with assistance from the Sahel Solidarity Programme of the Ecumenical Centre of Churches. It trains the staff of the offices of cooperatives and unions of cooperatives in various fields (management, storage, conservation and processing of products, etc.);
- The Technical and Vocational Training School of Boghé(TVTSB) which provides training in the fields of care and maintenance in agricultural machinery, agricultural techniques, machine driving, field crop management and rural crafts;
- The Higher Institute of Technological Education (HITS) of Rosso was created in 2009. HITS is the only technological higher education structure in the agricultural field that exists in the country. HITS's mission is to develop and offer high-level training, research and extension programs that anticipate and adequately respond to the requirements and challenges of sustainable development of the agropastoral and agri-food sectors in the country. It provides students with specialized and multidisciplinary training in the agricultural, pastoral and agri-food fields.

7.3.5.2. Indicators and their shortcomings

Within the NCARAD, the available research staff in 2016 was composed of 9 researchers and research assistants, 3 rural economy drivers and a rural economy monitor **(source: NADP 2016-2025)**

Within HITS, the Department of Plant Production and Protection has seven (7) teacher-researchers in 2023. **(Source: HITS, 2024)**

According to a study conducted in 2018 by Agricultural Science and Technology Indicators (ASTI), managed by the International Food Policy Research Institute (IFPRI), statistical data in agricultural research and development in Mauritania show that the major constraints for the development of agricultural research are:

- Insufficient research budget: The country invested only 0.49% of its GDP in agricultural research in 2016, which is well below the level required to sustain long-term agricultural productivity growth while the target for investment in agricultural research is set at 1% by the United Nations and the African Union.
- Lack of qualified agricultural researchers: The lack of qualified agricultural researchers in many fields. NCARAD did not have plant breeders and socioeconomists with PhDs, despite the crucial importance of this area of research;
- These capacity constraints are one of the main reasons for the extremely low number of new varieties released in the country and the development of agricultural technologies, compared to other West African countries;
- Mobilization of funding: A critical mass of qualified researchers is crucial for the implementation of viable research programs, for effective communication with stakeholders, and for securing external funding.

- **Agricultural researchers, by sector**

Given the country's climatic conditions, Mauritania gives less space to agricultural and zootechnical research. Fisheries research dominates its agricultural research agenda, absorbing 38% of the total number of agricultural researchers in 2016. The most studied crops are rice, wheat, cowpeas, fruits, maize, vegetables, sorghum, potatoes, and sweet potatoes.

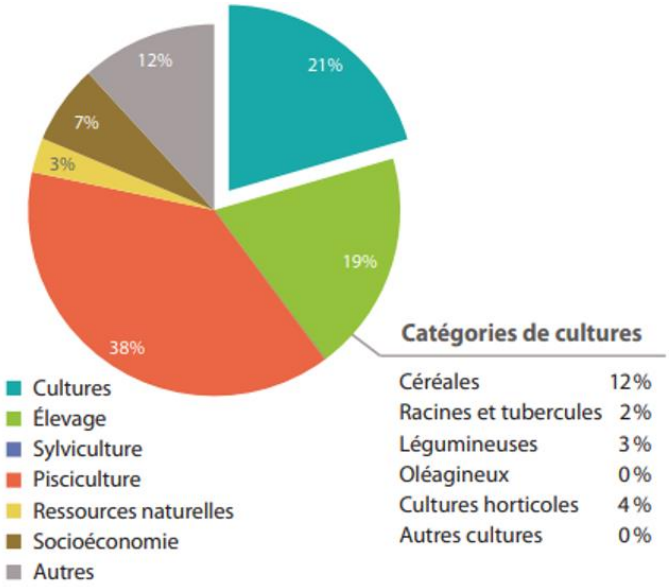


Figure 22: Distribution of researchers by sector in Mauritania.

Source: ASTI 2018

- **Main interventions according to the NADP:**

The main interventions to be developed by 2025 mainly concern the reorganisation of the research system and the strengthening of its human, logistical and financial capacities. This intervention involves:

- Strengthening the capacity of NCARAD's human resources through the establishment of a research staff statute
- Rehabilitation of 6 research stations according to the rules of the art
- The construction and equipment of 2 cold rooms, one of which is intended for the seed sector
- Strengthening the seed sector for the production of improved and certified varieties
- Increasing the operating budget for research,
- Strengthening mechanisms for communicating and disseminating knowledge to producers and agricultural advisory structures,
- Plant protection and soil science laboratory equipment
- Provision of research equipment and tools (seeder, rototiller, tractor, weather station)

7.4. Analysis of the Strategies Adopted and the Place of Agroecology.

7.4.1. The dynamics of agricultural growth in the main branches of production

The intensification of agricultural production will be achieved through the strengthening and improvement of access to production factors (land, water, hydro-agricultural facilities, equipment, seeds and other inputs, credits, etc.) as well as through the improvement and adoption of efficient technical itineraries. Diversification will focus on the cultivation of crop speculations other than rice and traditional cereals, particularly wheat and horticultural crops in the off-season, which are already an important reality in Mauritania's agricultural landscape. These crops are well suited for exploiting the agricultural potential of irrigated areas, including oases.

7.4.1.1. Actions planned according to the NADP for the period 2016-2025

7.4.1.1.1. Rice sector

- **Objective:** To achieve full coverage of rice needs by 2025.

To achieve this objective, two key factors will be taken into account: the evolution of the area to be developed and the intensity of cultivation practised.

As part of the NADP's projections, a crop intensity that will increase from 0.99 to 1.5 in 2025/2026 has been retained. The additional utilised managed area (UAA) will be 10,776 ha, an increase from an annual average of 1078 ha. This will correspond to an additional Gross Managed Area (MAA) of 12,677 ha, an average annual increase of 1268 ha.

Accordingly:

- Production will increase from 194,651 to 414,130 tonnes in 2025/2026 to cover rice needs. (Production will be 19% (119%) in surplus,
- The average rice yield increased from 5.08 t/ha (average period 2010-2015), used as a benchmark, to 5.62 in 2025/2026, an increase of about 11% over the period 2016-2025.

- **Main interventions**

Based on achievements and current potential, priority activities under the NADP should cover the following areas:

- Strengthening hydro-agricultural investments and water management
- Adoption, dissemination and application of more appropriate technical itineraries
- Securing production
- Improving the supply of quality seeds and fertilizers (reviving the seed sector to boost seed production)
- Quality control of seeds and inputs
- Promotion of forms of mechanization adapted to different types of farms
- Improving access to finance for rice cultivation
- Strengthening advisory support (technical, organizational and managerial) and cooperation between actors in the sector
- Creation of conditions that facilitate access to energy, in particular from wind and solar sources

- **Priority areas of intervention**

The Wilayas and priority areas of intervention are Trarza, Brakna, Gorgol and Guidimakha.

7.4.1.1.2. Traditional cereals sector

- **Objective:** To reach 60% of the dietary requirement for traditional cereals by 2025.

To strengthen national production of traditional cereals (sorghum, millet, maize) and reach 60% of food needs, it will be necessary, among other things, to act on (i) increasing exploitable areas, especially those behind dams, and (ii) improving yields.

The objective set can be achieved, if certain conditions are ensured, namely: (i) rigor in the application of technical itineraries for the management of the different crops, (ii) the mobilization of significant human and material resources in addition to financial resources, and (iii) the logistical and organizational capacity of the various actors in the implementation of the program.

The projections used for this sector are:

- An increase in the area behind dams and a consequent reduction in the area of dieri,
- The area under cultivation behind dams and dikes will have to increase from 16,622 ha to 31,307 ha, an increase of 14,685 ha.
- A utilization rate of the exploitable area (cultivated area/exploitable area) that increases from 63.45% to 82.3% in 2025,
- An average yield that increases from 0.487 t/ha to 0.717 t/ha in 2025 (for all production systems). This is achieved through the application of efficient technical itineraries and easier access to the factors of production,
- An additional 14,685 ha of cultivated area behind the dam.

- **Main interventions**

The main interventions to be implemented are the following:

- Water Mastery
- Support for crop protection
- Dissemination of improved technical itineraries adapted to climate change
- Development of the seed sector at the farmer level
- Improved access to production factors (seeds, fertilizers, etc.)
- Promotion of forms of mechanization adapted to different types of farms
- Access to rural microfinance

- **Priority Intervention Zone**

The entire Sahelian zone characterized by dieri is concerned by actions to intensify traditional cereals. The wilayas of the Centre and the East are the ones interested in the creation of the new dams.

7.4.1.1.3. Wheat sector

- **Objective** : To contribute to the satisfaction of wheat needs by 11% by 2025. To achieve this objective, it will be necessary to act on the increase in cultivated areas and on the improvement of yields.

To achieve the set objective, the additional areas to be developed by 2025 are as follows:

- 7,114 ha irrigated at a rate of 711.4 ha per year;
- 7,141 ha behind dams at a rate of 714.1 ha per year.

- **Main interventions**

The main interventions are:

- Strengthening hydro-agricultural investments
- Dissemination and application of more appropriate technical routes for the cultivation of wheat
- Improved seed and fertilizer supply
- Promotion of mechanization
- Improving access to finance
- Strengthening support and cooperation between actors in the sector

- **Priority areas of intervention**

The eastern regions of Hodh El Gharbi, the centre (Assaba, Tagant), the river (Trarza and Brakna) and the north (Inchiri, Adrar).

7.4.1.1.4. Horticultural sector

- **Objective:** Increase horticultural production to cover 32% of onion and 8% of potato needs and 63% of other products in the sector by 2025.

To achieve the set objective, it will be necessary to act on the increase in cultivated areas and the improvement of yields (modernization of production systems). In 2025, approximately 8,771 ha will need to be exploited, including 2,771 ha of existing land and 6,001 ha of new developments, corresponding to an estimated gross area of 7501 ha.

This target targets a production of approximately 24,982 tonnes of onions, more than 3,259 tonnes of potatoes and 118,008 tonnes of miscellaneous vegetable products.

- **Main interventions:**

In order to achieve the defined quantitative objectives, the main activities to be carried out will focus on:

- Strengthening water management
- Improving access to quality inputs
- Improving access to agricultural finance
- Dissemination of technical itineraries adapted to agro-ecological conditions
- Promotion of specific actions for market gardening in peri-urban areas
- Promotion of specific actions for market gardening in oasis areas

- Strengthening support and cooperation between actors in the sector
- Development of banana production
- Promotion of fruit growing

- **Priority areas of intervention**

Agricultural land for market gardening with and/or that can be equipped with hydro-agricultural facilities, in particular irrigated areas in the Senegal River valley, land around ponds, oases, and peri-urban areas around Nouakchott and other cities located or supplied from large aquifers (Dhar, Benichab, etc.).

7.4.1.1.5. Support for the development of oasis cultures

- **Objective:** To improve the coverage rate of date needs by 2025

To achieve this objective defined by the RSDS, interventions will have to concern, among other things, the increase of new plantations (about 500 ha due to 50 ha per year), the increase in yields of old plantations through the adoption of more efficient technical itineraries, as well as the reduction of post-harvest losses.

- **Main interventions**

To achieve the objective, the main interventions to be developed can be broken down as follows:

- Water Mastery
- Support for crop protection
- Construction of the in vitro culture production laboratory and the date and vegetable packaging centre
- Regeneration of the phoenicicultural heritage: new plantations and regeneration of old ones
- Improvement of technical routes

- **Priority areas of intervention**

The wilayas of Adrar, Tagant, Assaba, Hodh El Gharbi and Hodh Charghi

7.4.1.1.6. Sugar sector

- **Objective:** To cover 42% of white sugar needs by 2025

This objective, defined by the RSDS, aims to achieve a production of more than 88,5000 tonnes of white sugar by 2025 from sugar cane grown on 10,000 hectares.

- **Main interventions**

Sugarcane cultivation is being developed as part of the implementation of the Agro-Industrial Complex Project for Sugar Production. The agricultural component of this project includes:

- Development of an area of 10,000 ha by 2025,
- Sugarcane production using appropriate irrigation and cultivation techniques
- Acquisition of agricultural equipment.

- **Priority areas of intervention**

The areas of Foum Gleïta and Ganki in the wilaya of Gorgol

7.4.1.2. Review of the 2022-2023 crop year

At the national level, the area sown during this season reached 379,047 hectares (ha) with a gross production of 662,345 tonnes across all sectors. These results are shown in the below table:

Table 36: Review of the 2022-2023 crop year in Mauritania

Spinneret	Area (ha)	Forecast average yield (tonne/ha)	Production (tonne)
Traditional crops sector	300 696	0,485	145 940
Rice sector	72 379	5,7	410 201
Wheat sector	737	2	1 504
Market gardening sector	5 235	20	104 700
Fodder sector	Stream in the introductory phase		
Total	**379 047**		**662 345**

Source: Ministry of Agriculture 2023

The good results of this campaign are mainly the effect of a good winter, the declaration of the year 2022 as the "Year of Agriculture" and the strong awareness that followed, but also thanks to a set of measures that have been taken.

The analysis of production by sector confirms the performance of rice production, which has recorded a steady increase in production compared to the average of the last five years, bringing the coverage rate of this cereal to about 86%. As far as vegetables and wheat are concerned, their contribution is still low for vegetables (potatoes, onions, tomatoes, carrots) and almost zero for wheat.

Despite this low level of vegetable production, it should still be noted that it contributes to the supply of certain consumption centers during the blessed month of Ramadan 2023, particularly for certain products (squash, eggplant, watermelon, turnip, etc.).

7.4.1.3. Actions planned for the 2023-2024 campaign

The objectives for the 2023-2024 agricultural season are to develop 389,740 ha for an expected production of 776,700 tonnes from the various sectors. These objectives are broken down as follows:

Spinneret	Area (ha)	Forecast average yield (tonne/ha)	Production (tonne)
Traditional crops sector	300 000	0,5	150 000
Rice sector	80 000	5,5	440 000
Wheat sector	1 200	2	2 400
Market gardening sector	8 000	20	160 000
Fodder sector	540	45	24 300
Total	**389 740**		**776 700**

(*Source*: Ministry of Agriculture)

To achieve the objectives of this campaign, which will be implemented over 12 months (June 2023 - June 2024), the following measures have been taken:

- **Traditional cereals sector:** (a) Rehabilitation of 57 new dams for 5468 ha, reinforcement and construction of 2501 dikes and bunds for 7500 ha (b) 1010 tons of traditional seeds including 120 tons of wheat (c) 2030 km of wire mesh and barbed wire for crop protection (d) 6700 liters and 191 T of control products (d) 476 rototillers, 149 tractors, 15 mini-tractors, 390 mowers, 3700 units of materials and equipment;
- **Rice sector:** (a) development of new perimeters for 6141 ha (b) dredging and partial mowing of 27 hydraulic axes and irrigation channels at the level of Trarza, Brakna and Gorgol (c) opening up of 29 km at several sites in Trarza (d) acquisition of 8 tractors, 4 harvesters, 1 maintenance brigade and 45 motor pump units for the benefit of certain collective perimeters (e) acquisition of 25000 tons of urea, 10,000 tons of DAP, 500,000 liters of herbicides (f)13,000 liters of chemicals, 600 sound detonators and 40,000m of catch nets for alternative control, 12 mobile teams, 5 drones and a military aircraft.
- **Market gardening:** (a) acquisition of 8 tonnes of ordinary and hybrid seeds, 550 tonnes of potato seeds, (b) 3000 tonnes of compound fertiliser, (c) 20000 units of horticultural equipment, 129 solar pumping kits, 165 kits of drip irrigation equipment, (c) 3450 litres of control products, (d) 102 boreholes, (e) 31 greenhouses, (f) 523 ha of new horticultural facilities.
- **Oasis sector:** (a) Rehabilitation and development of 32 sites for 400 ha and their equipment by collective irrigation networks (b) construction of 112 new boreholes (d) 40km of fencing (e) construction of 27 slowdown thresholds (f) acquisition of 20000 protective nets for the regimes in addition to various products to control the enemies of the palm tree and 160 units of equipment (motorized pollinator ladders, (g) acquisition of 10000 vitro Berhi and Mejhoul palm seedlings.
- **Wheat and fodder sector:** These two sectors are considered to be in the introduction phase into the agricultural system because of their strategic importance for achieving food security. These sectors will be supported through the acquisition of seeds and specific equipment.

7.4.1.4. Areas of intervention in the short and medium term

The country's food self-sufficiency in basic foodstuffs remains a major objective on which all the department's efforts are directed. To achieve this objective, emphasis will be placed on an approach focused on the extension of facilities and the improvement of productivity through the concentration of efforts in the future on the following axes:

- The exploitation and extension of developments: The extension and operation of developments face certain constraints, including the complexity of traditional land tenure, the cumbersome land regularization procedures and the partial exploitation of land already allocated for agricultural use.
- Agricultural financing and insurance: This axis is of paramount importance for the development of the agricultural sector, particularly for the promising sectors (rice, market gardening and wheat). In this context, the department is in the process of launching a study that should propose an

appropriate financing and insurance system. The deliverables of this study are expected before the end of the year;

- Agricultural mechanization: its importance is no longer to be revealed because it reduces manual work and fills the shortage of manpower that is experiencing a mass exodus from production areas. During this campaign, a large quantity of tractors and various equipment for the field work will be acquired. The operation faces a number of difficulties, including the lack of after-sales service and the lack of management structures. Given the urgency of making this material available to the current campaign, the department will entrust National Society of Rural Developement (SONADER) in the river zone and National Society for Agricultural Development and Works (SNAAT) in the rainwater zone with the management of this equipment according to a participatory management approach with the socio-professional organizations benefiting from this equipment.
- The electrification of production areas: this axis is considered to be a determining factor in the reduction of operating costs. The department is working in consultation with the Ministry of Petroleum, Energy and Mines to accelerate the completion of the electrification work underway and extend this action to other production areas;
- The construction of conservation and storage infrastructures: The intervention in this field consists of encouraging and supporting private investors interested in the construction of storage, conservation and processing infrastructures. In this context, work is underway for the construction by private companies of three centres with a capacity of 15000 tonnes at the port, Rosso and PK 17 in addition to a centre in Rosso with a capacity of 1000 tonnes already built by the national army.

At the same time as the implementation of these axes, the Ministry of Agriculture is working within the framework of its sovereign missions to revitalize the seed sector, strengthen the agricultural advisory system, research and training as well as plant protection.

7.4.2. The place given to agroecology in agricultural strategy papers

7.4.2.1. Food and Agricultural Strategies

The term "agroecology" is not explicitly mentioned in food and agricultural security strategies. The NFSS refers to land and water management in its Pillar 1 based on its programme for environmental protection and the fight against desertification and silting. The RSDS in its axis 4 talks about the participatory management of natural resources. The NADP, too, takes into account from a technical perspective the diversification of production, the improvement of production systems and the sustainable management of natural resources. The NADP sub-programs in question are:

- Sub-program 1.1. : Diversification of irrigated agricultural production
  - Sub-program 1.2.: Improvement of rainfed production systems for the enhancement of traditional crops
  - Sub-Program 3.1: Improved Land Management, Protection and Rehabilitation of Agricultural Land

- Sub-program 3.2: Improved wetland management and development.

Pillar 1 of the NFSS, Axis 4 of the RSDS and the sub-programmes of the NADP touch on some of the FAO's agroecology principles, which are: Diversity; Co-creation and knowledge sharing; Food cultures and traditions; Human and Social Values and Responsible Governance.

7.4.2.2. Environmental Strategies

Strategic axis 2 of the NESDS also devotes its three intervention themes to the integrated and sustainable management of natural resources and terrestrial biodiversity.

But beyond NESDS, the MESD's updated Nationally Determined Contribution (NDC) for the period 2021-2030, which serves as the framework for defining the country's climate policy, clearly mentioned the term "agroecology" as measures for mitigating and adapting to climate change. These actions are in line with some FAO principles of agroecology (Diversity; Resilience; Efficiency; Human and Social Values and Responsible Governance).

Indeed, it is planned to:

- Promote 6,000 ha of organic agriculture/agroecology by 2030;
- To ensure organic soil cover / Conservation agriculture over an area of 10,000 ha/year by 2030.

Other measures to adapt to climate change by 2030 touch on agroecology from technical perspectives:

- Improving agricultural productivity and using climate services
- Restoring Agricultural Land Fertility
- Land Degradation Neutrality
- Strengthening ecosystem resilience and biodiversity conservation;
- Sustainable wetland management and conservation

7.4.3. Weak signals evoking or promoting agroecology in the country

In recent years, many development projects have been and are being developed in the promotion of agroecology. The largest donors (AFD, EU, IFAD, AECID, CCFD-TS, etc.) are interested in the potential of agroecology as a means of production for smallholder farmers, and see this system as an approach to adapting to climate change. These projects are mainly implemented in the Mauritanian regions bordering the Senegal River Valley. Agroecological market gardening is of increasing interest to farmers, as rainfed crops are increasingly at risk due to recurrent droughts, and rice cultivation as it is currently carried out has high operating costs, for which farmers have to seek credit or loans.

Technical itineraries favourable to agroecology are increasingly promoted. Producers are beginning to become aware of the differences between conventional and agroecological products. Especially since Mauritania is a pastoral country, organic matter is sufficiently available for soil fertility needs. The consumption of inputs decreases considerably among producers directly or indirectly affected by these agroecology promotion projects. This reduction is achieved in favour of biofertilizers, biopesticides and the use of farmers' seeds. There is also a great diversification of crops within the plots, as well as crop associations and rotations. Techniques

for water management and soil defence and restoration are known to producers. As far as soil preparation work is concerned, many small-scale producers use animal traction in the Senegal River Valley. They were trained in the use of cassines and houssines, but some were also able to benefit, through development projects, from the reinforcement of knowledge on the manufacture of these tillage tools.

In almost all regions of the country, associations of young producers and/or young individual entrepreneurs have emerged and are becoming increasingly sensitive to issues related to climate change. Agroecology-oriented agricultural production and awareness raising on local consumption are increasingly taking place in urban areas.

Although the term "agroecology" was not addressed in the 2016-2025 NADP, the Ministry of Agriculture supports many partners in the implementation of programs related to this theme. There is hope that when the next strategy and its action plan are developed, the ecological transition of the agricultural sector and in particular agroecology will be taken into account as a set of agricultural concepts and practices but also as mitigation and adaptation measures to the effects of climate change.

7.4.4. Existing expertise and information in the field of agroecology

The main support activities of the National Centre for Agronomic Research and Agricultural Development (NCARAD), as already mentioned above, are: the production of fruit plants, (ii) the support of the Ministry of Agriculture in various development programmes, namely: the programme for the production of pre-basic wheat seeds and the programme for the development of fodder crops. The main interventions to be developed by 2025 will focus mainly on the reorganisation of the research system and the strengthening of its human, logistical and financial capacities.

The Higher Institute of Technological Education (HITS) in Rosso has researchers but no publications in the field of agroecology within their plant production and protection department.

Based on this information, it can be said that currently there is no scientific expertise in the field of agroecology in the country.

However, technical skills (engineers, extension workers) exist within national and international NGOs working in rural development in Mauritania. In the implementation and monitoring of projects, these skills are transferred to small farmers, cooperatives and associations and this sharing of knowledge is reversible... Some producers, through their experiences, can share their knowledge with their peers through the farmer-to-farmer methodology.

Information on the field of agroecology mainly concerns tillage, insect and disease control, organic soil amendment, crop fertilization, water resources management, soil defense and restoration, crop association and rotation.

This information is produced by NGOs working in the field of agroecology and is shared during training and knowledge-sharing workshops, on notes, leaflets, within the framework of projects through the establishment of farmer field schools and exchange visits.

7.4.5. Barriers to agroecology

There is a close correlation between the productive capacities of the different agro-ecological zones, natural resources and their farming systems. Although there are several natural factors (drought, erosion,) determining the loss of soil quality or the reduction of water availability, some anthropogenic factors affect natural resources, including: overgrazing, poor cultivation practices, deforestation, bush fires, overexploitation of the water table, etc.

Although agroecology has been addressed from technical angles in the NADP, some programmes are not in line with the theme of agroecology, such as those oriented towards the intensification of agricultural production, which is done through the strengthening and improvement of access to production factors (land, water, hydro-agricultural facilities, equipment, seeds and other inputs, etc.). credits, etc.). This action aims to overexploit natural resources (water, land, biodiversity) especially in areas characterized by a high degree of isolation and scarcity of water resources as a result of drought and overexploitation of the water table. The continued clearing of woodland for agriculture is also to be taken into account.

It is therefore necessary that all plans or programmes for the intensification of agricultural activities take into account the impact on natural resources and the environment in general. To this end, the use of resources must be rationalized through appropriate tools and techniques to promote sustainable agricultural development.

To support all agricultural sectors, the NADP refers to the improvement of supply chains for inputs (seeds, fertilizers, phytosanitary products) for agricultural intensification. In July 2023, during the communication to the Council of Ministers No. 23 relating to the 2023-2024 agricultural season, the Minister of Agriculture mentioned:

- The provision of hybrid seeds to producers;
- The granting of a subsidy of around 37% on urea, 55% on DAP with 45% of the dose free of charge of this input, and 50% on market gardening fertilizers and herbicides;
- Agricultural mechanization: acquisition of two-wheel tractors, tractors, mini-tractors, mowers, etc. Their importance for agricultural intensification is well established as it reduces manual labour and fills the labour shortage, which is experiencing a mass exodus from production areas.

In terms of intensive technical model, foreign agribusiness has been set up on the banks of the Senegal River in recent years. The aim of these agribusinesses is to exploit the natural resources of local populations (water, land, etc.) for agricultural production for commercial purposes because all products are exported to Europe in general. It should also be noted that in order to set up, these firms clear thousands of hectares of wooded land.

Among the technical obstacles identified and which hinder the development of agroecology, we can mention: inadequate irrigation (poor water management, irrigation, drainage, etc.); the use of fertilizers, dangerous pesticides, etc. Inadequacy of soil conservation and restoration techniques, lack of control of certain practices that affect production.

Engineers in the technical services of agriculture have knowledge in the field of agroecology, but this is not really made available to producers. The inadequacy of human, logistical and financial resources most often limits their specifications, and as a result, support does not meet the needs of producers and knowledge is not

shared as it should be. According to some farmers, the technical services only visit them when the inputs are being distributed for the start of the crop year.

7.5. Main Results of the Interview Guide

7.5.1. The methodology used

As part of this activity, the aim was to question representatives of different categories of actors on their perception of agro-ecology. The interviews should revolve around their knowledge of agroecology, is this a constraint or a necessity? What are the risks and benefits of practicing agroecology? And finally, what are the needs?

These questions were almost similar to those asked during the territorial diagnosis phase of PK17 in Nouakchott. The actors who had been interviewed were from the Ministry of Agriculture and its technical services decentralised in Nouakchott and Guidimakha, the Ministry of Environment and Sustainable Development, the Region of Nouakchott, the Town Hall of Riaydh, representatives of cooperatives, individual farmers, FAO and several NGOs (national and international) based in Nouakchott but which intervene on the theme of agroecology in different regions of the country. country.

Since we already had feedback from these actors, we then took advantage of a field mission of another GRDR project, to interview the decentralised technical services of agriculture of Guidimakha, the representatives of the few collective structures (cooperatives in Gorgol and Guidimakha) and individual farmers.

The farmers (individuals and cooperatives) interviewed are all in the category of small-scale family farmers who do market gardening in Nouakchott and diversify between market gardening crops and rainfall/flood recession crops in Gorgol and Guidimakha.

7.5.2. Stakeholders' responses

- **Individual farmers and cooperatives**

Individual farmers are all in the category of small-scale family farming. As part of the interviews, we were able to select 8 interviews from those conducted in Nouakchott and conduct 3 in Gorgol and 2 in Guidmakha. A total of thirteen (13) individual farmers including 6 women.

As for cooperatives, their objectives are to meet their food needs and strengthen the social cohesion of their members. We were able to talk to 2 cooperatives in Nouakchott, 1 in Guidmakha and 4 in Gorgol. In total, there are seven (7) of them, including 5 women's cooperatives and two (2) mixed cooperatives.

The following responses were noted:

- Few are familiar with the term agroecology but use agroecological practices
- The most widely practiced agroecological techniques: use of organic matter, use of natural product treatments, crop rotation and diversification, water management.
- 4 individuals and 5 cooperatives benefited from training on Agroecology provided by NGOs.
- Knowledge of health and environmental benefits
- No support from the technical services of agriculture

- Production in agroecology requires more resources, energy and patience
- Incomes identical to those of conventional farming

- **Ministry of Agriculture and Technical Services**

At the central level, the Ministry of Agriculture admits that the agricultural strategy and its national action plan 2016-202 do not directly take into account the "agroecology" component. Moreover, the MA is not implementing any programs/projects related to agroecology during the current period. Nevertheless, they recognize the efforts made by United Nations agencies (WFP, FAO, etc.), national NGOs (AMAD, ECODEV, ROSA, Tenmmiya, Caritas Mauritania) and international NGOs (GRDR, GRET, ACF, WV, CONTREPART, CERAI etc.) throughout the territory for the promotion of agroecology and the vulagiation of its practices/techniques (especially in the regions bordering the Senegal River). In view of the CC and its adverse effects, the next national agriculture strategy must be updated from 2026 and will directly take into account agroecology while promoting means of production that protect human health, the environment and preserve natural resources as recommended by the AGSPS 2 and the updated NDC 2021-2030 which includes among its national adaptation priorities; the restoration of biodiversity and ecosystems, the development of agroecology, access to water and the strengthening of the resilience of vulnerable populations.

At the level of the decentralised technical services, interviews were held with those of Riadh (Nouakchott) and those of Sélibab (Guidimakha). The replies were as follows:

- Little Knowledge of Agroecology
- Agroecology mentioned in the PPs from technical angles: management of natural resources (water, land, biodiversity, etc.)
- Needs of the population not met by local production
- Ensuring self-sufficiency in vegetables and thinking about agroecology afterwards
- Gradual agroecology transition in the field
- Department technicians not trained in EAPs
- Financial, logistical and human resources that do not allow for continuous support for farmers.

- **NGO representatives**

If the agroecological transition is progressing in Mauritania, the thanks are due to the interventions of the various national and international NGOs that develop programs and projects related to the theme of agroecology. The latter are mostly implemented in the regions bordering the Senegal River where agricultural activities are dense and this is due to the availability and quality of the soil but also to the presence of the river which allows the irrigation of market garden plots and the quantities of rainfall which allow prluvial crops and flood recession. These NGOs strengthen the capacities of farmers, whether they are individual or in management, on several aspects of agroecology but also raise awareness on the consumption of healthy products, on the preservation of the environment and the management of natural resources. Following our interview with the FAO and 6 NGOs involved in agroecology, we were able to note the following feedback:

- Knowledge of agroecology within NGOs

- Development of programs/projects on the following themes: Raising awareness on healthy consumption; Soil defence and restoration; Prevention of conflicts related to natural resources; Promotion of agroecological practices and techniques in the plots; Management of natural resources (water, rangelands, land, forests, etc.); Transition to Peasant Agroecology; Building Resilience to CC Shocks, Resilience of Sustainable Food Systems...
- Need for intensification of agroecology as an adaptation measure to the effects of CC
- Mandatory support from the State, the Ministry of Agriculture and its regional delegations
- Taking agroecology into account in the next agricultural strategy
- Allocate sufficient budgets to agroecology and agricultural research to achieve the objectives set in terms of food security but also mitigation and adaptation to CC

7.6. Conclusion

Despite significant opportunities, Mauritania's food systems are unable to meet the food needs of the population in sufficient quantity and quality, due to various constraints such as weak infrastructure and governance, lack of territorial, intergenerational and gender equity, the country's dependence on imports and the lack of human capital development. In addition, there is a lack of funding and support in key sectors (agriculture, livestock, natural resources, research, etc.) in the areas where Mauritania's sectoral policies must include mitigation and adaptation measures. Policies that are slow or fail to achieve the objectives set.

In Mauritania, only the NDC has proposed in its action plan to promote agréoology, which is somewhat forgotten... However, other strategies take into account the rational management of natural resources. These natural resources, which are most often a source of conflict between producers and herders, are becoming increasingly scarce.

The participation of NGOs is to be welcomed because they are, on the one hand, the precursors of actions to raise awareness and resilience of food systems in the face of CC and, on the other hand, partners of the various ministries for a better awareness and adequate interventions on these issues of preservation of natural resources, local consumption, human health and conflict resolution between agro-pastoralists in public policies.

Moreover, the RSDS and the NADP will expire in 2025 and their updating should normally, in addition to the actions already mentioned, make it possible to improve a package of technologies, to create an environment conducive to access to production factors and investment at the level of both small and large producers, to adapt the financing system to the specificities of the different sectors without omitting the crucial field of research, thus structuring the actors of the agricultural sector. These various actions represent elements that can increase the quantity and quality of agricultural production. These can increase their value on both the national and regional markets and ensure a certain competitiveness, especially with regard to products that are widely imported and consumed by the population.

Chapter 8

National Report for Morocco

Taha Lahrech (IAV HASSAN II)

Chapter Eight National Report for Morocco

8.1. Introduction

The increasing virulence of climate change has put the terms of a long-unbalanced relationship between economic growth and the sustainability of human systems back on the table. This virulence has taken the opposite view of the ten-year developmentalist sectoral strategies in the early stages of their implementation or in the course of their implementation. It has also hidden itself in the Covid-19 smokescreen, at the end of which various countries have rushed towards economic recovery and the reduction of unemployment, voluntarily or involuntarily relegating "the ecological ball" to second place.

The criticality of climate change is reaffirming itself every year in crescendo, so much so that the weight and consideration that we currently give to it in our strategies are quickly outdated. While the fear of a repetitive drought is not necessarily inevitable, and fortunately, it does revive hope in a few normal or rainy years on which farmers and public policies are projecting themselves to build optimistic scenarios, and therefore, a relative continuity of our production and farming methods.

In Morocco, sectoral and intersectoral strategies are increasingly part of global convergence. It can be said that the decade 2020-2030 has been centred on the human element, particularly with regard to the Green Generation strategy and its first pillar, strategies to promote entrepreneurship (rural and urban) such as the Intelaka programme, the operationalization of a new system of direct financial transfers for the poor and vulnerable population, the generalization of access to social protection and health insurance, etc.

This convergence is just as noticeable from an environmental point of view, but not yet with the same acuity, one might say. Morocco's organization and participation in the COPs, and the presentation of its Determined Contribution, among other international events, reinforced its commitment to include the environmental aspect, sustainability and resilience in all its orthodox strategies, as will be presented in this report. However, there are still many aspects that retain the expression of full unconditional commitment to the environment, and in most countries for that matter.

Producing ecologically resonates in people's consciousness as "producing less", in the absence of a revolution that will show us how to produce ecologically AND identically, or even comparably. This dilemma gives rise to a spectral trade-off between economics and ecology, where other considerations are added to further complicate the equation: the ecologically "tradable" economic margin has shrunk considerably, the common water base is precipitating producers towards the famous tragedy of the commons, and the uncertainty linked to the future carries the hope of a return to normality that advocates equanimity in the face of the present.

Productive sectors that are "under social and economic pressure" rely more on society's resilience to climate change than on ecological action FOR the environment, it can be observed. On the other hand, sectors that are more comfortable in terms of the relationship between resources and humans, such as fishing, are better students on paper when it comes to environmental preservation planning that aims for the long term.

The international environment also has a very decisive contribution in this regard. While international agreements and financing conditional on environmental action are assets for international convergence towards sustainable systems, the global economic system as built on competition for currency and balance of payments continues to feed the now decontextualized dogma of economic "growth".

Today, globally, obstacles of various kinds complicate the adherence to a frank and total agroecological transition. International trade treaties, diplomatic relations, and social, economic, and food issues (to which are added political games) make the transition a developmentalist project that must deal with all these constraints.

For its part, Morocco is evolving in this constrained environment in a fairly balanced way. After the 2000s, he launched several ambitious projects, investing on all fronts. This a *priori* inflated dynamic is nevertheless taking place in the context of the greatest budgetary prudence and macroeconomic stability. It is therefore important to have an idea of the ecological consistency of these strategies, which will allow us to contribute by bringing a distant perspective to this dynamic.

8.2. Background

8.2.1. The main indicators of agriculture

- Agricultural value added

Agricultural GDP stood at 130 billion dirhams in 2022, i.e. nearly 10.8% of the total PV, and 9.8% of the GDP (with territorial correction). It varies globally between 10% and 18% depending on whether the years are dry, normal or rainy. The evolution of agricultural GDP recorded in 2022 reflects a decrease of -12.9% (at the price of the previous year) compared to 2021, mainly due to climatic conditions. Thus, in a dry year, agricultural GDP has a negative impact on overall GDP growth.

Despite its limited contribution to the country's GDP compared to other sectors of the economy, agriculture weighs on national performance due to the employment rate, which stands at nearly 40% of the active population, which in turn impacts the purchasing power of the rural population. It also weighs on the fact that it is the sector whose added value is the most volatile, and therefore the riskiest, in the national economic mix.

Table 37: Economic Indicators for Agriculture in Morocco

	2010-17	2018	2019	2020	2021	2022
GDP at current prices (DH million)	993 585	1 195 237	1 239 836	1 152 477	1 274 727	1 330 158
GDP growth (%)	3,5	3,1	2,9	-7,2	8,0	1,3
Total value added (DH million)	906 603	1 071 144	1 110 527	1 036 049	1 143 497	1 200 946
VAT growth (%)	3,4	3,1	3,0	-7,0	7,8	1,0
Agriculture and hunting (In million DH)	106 482	127 084	127 851	117 094	143 963	130 299
Agricultural PV Growth (%)	2,9	5,6	-5,0	-8,1	19,5	-12,9
Agricultural VA share of GDP (%)	10,7	10,6	10,3	10,2	11,3	9,8
Agricultural PV share in overall PV (%)	11,7	11,9	11,5	11,3	12,6	10,8

(*Source*: High Commission for Planning (2023))

The volatility of agricultural growth has decreased over generations. The following figure shows the volatility by decade, which went from a ratio of 1 to 7 to a ratio of 1 to 3 for the decade 2009-2020. The decrease in volatility reflects the fact that agricultural strategies have so far been successful in reducing the "immediate" impact of

rainfall on the overall performance of the sector. Indeed, the switches between dry years and better years no longer give rise to strong variations in agricultural PV. The latest agricultural strategies have made it possible to mobilize irrigation water and encourage crop conversions, thus reducing the share of rainfed cereal cultivation in the agricultural VA. Indeed, the breakdown of agricultural PV by production sector shows a clear decline in the cereal sector, which fell from 15.8% of the AAV to 6.3% between 2014 and 2020. This is due to both crop conversion and the effect of drought.

Comparing the graph in Figure 23 with the rainfall graph (Figure 32), it can be concluded that the agricultural strategy has increased the immediate resilience of the sector by smoothing out annual variations due to rainfall. But *what about* long-term resilience?

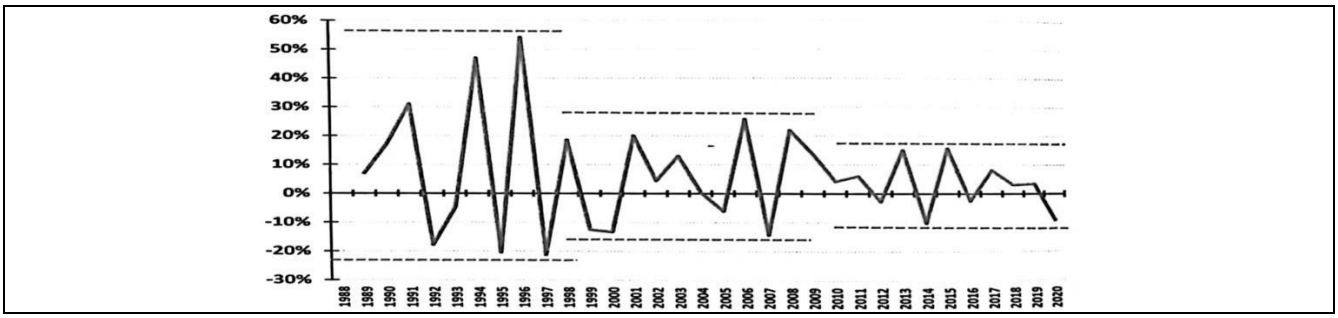


Figure 23: Ten-year volatility of agricultural growth 1988-2020 in Morocco

(*Source*: situation of Moroccan agriculture N°15)

- Agricultural employment

In the 1960s, agriculture employed 65% of the male workforce. The share of agricultural employment has gradually declined over time to 43% of total employment between the 1990s and 2005. From 2005 onwards, the share of agriculture declined to less than 35% from 2016 onwards. Its evolution is the result of several contrasting and opposing dynamics, such as immigration, the emergence of the secondary and tertiary sectors, the rural exodus, agricultural entrepreneurship induced by agricultural strategies, etc.

Overall, in rural areas, the structure of employment is still dominated by the "agriculture, forestry and fisheries" branch with 62% of rural employment, followed by "services" with 17.9% and "industry" with 14.1%.

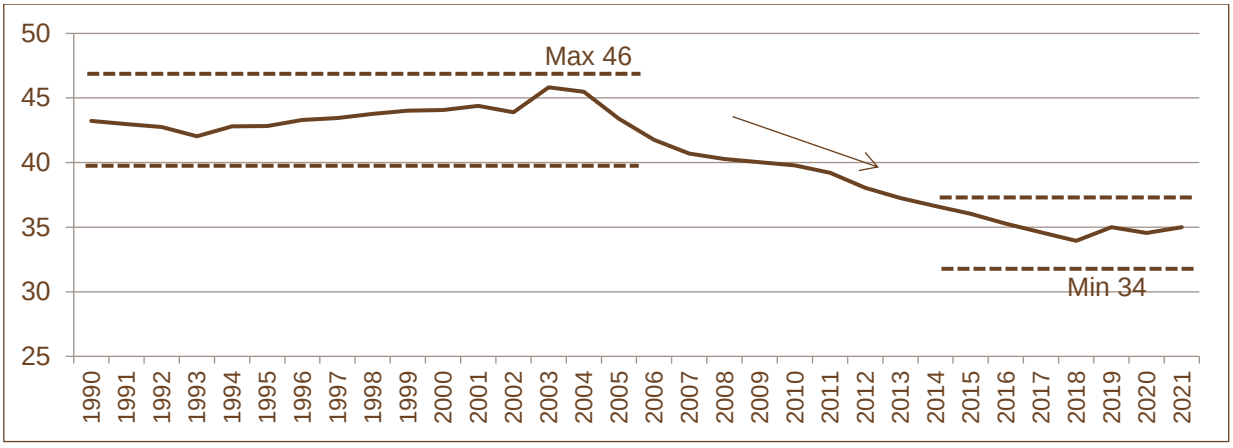


Figure 24: Evolution of the share of agricultural employment in total national employment (in %) in Morocco

(*Source*: World Bank Statistics)

However, the number of working days per agricultural worker increased by almost 43% between 2003 and 2000, despite the marked development of mechanisation and automation. The generalization of drip irrigation and the use of agricultural machinery has made it possible to optimize agricultural work to identify it at the level of what is necessary and make it more productive. The increase in the number of working days can be attributed, among other things, to the dynamics of investment (not only operational work), to the nature of agricultural work which has shifted towards high value-added activities that require more work and processing.

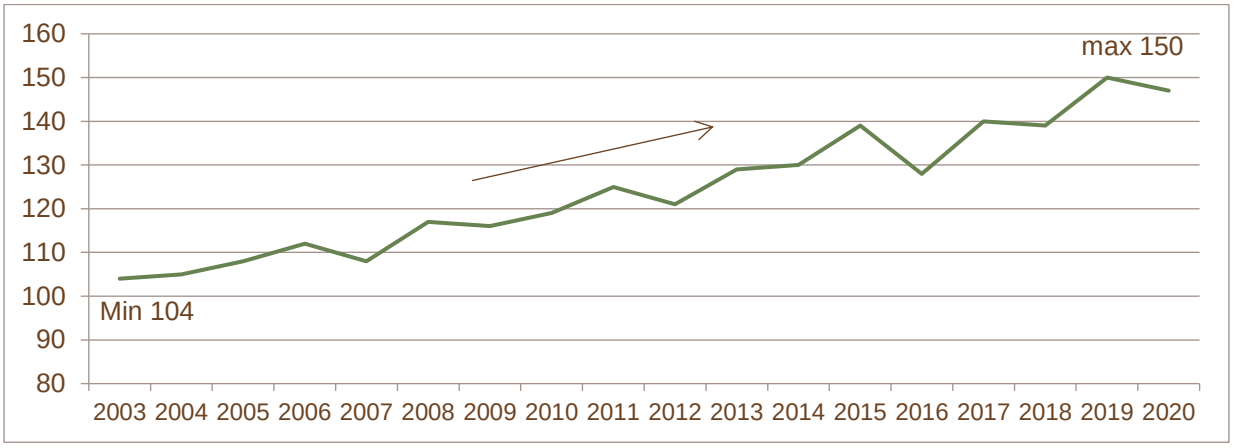


Figure 25: Evolution of the number of days worked in agriculture per agricultural worker in Morocco

(*Source*: situation of Moroccan agriculture N°15)

- Agricultural trade

Exports. The dynamism of the agricultural exports sector has enabled Morocco to position itself as one of the world's leading exporters of agricultural products. In particular, it is the world's leading exporter of capers and argan oil, the world's 3rd largest exporter of canned olives and small citrus fruits, and the world's 4th largest exporter of tomatoes.

Compared to the European Union market, Morocco is positioned as the leading extra-EU supplier of tomatoes and canned olives, the 2nd largest extra-EU supplier of olive oil and the 3rd largest extra-EU supplier of citrus fruits.

Overall, exports in value of agricultural products reached 33 billion dirhams in 2020 compared to 16 billion in 2015, an increase of 46% in 5 years. The share of agriculture in the country's total exports increased from 7.47% in 2015 to 12.5% in 2020. It exceeded the value of agri-food exports, which also recorded a level of 32 billion dirhams in 2018 before falling again to 28 billion in 2020.

Table 38: Evolution of exports from the agricultural sector to the national economy (in MDH) in Morocco

	2015	2016	2017	2018	2019	2020	Δ 20/15%
Total Exports	218 040	225 651	548 493	275 441	284 496	262 795	20,53
Agriculture and Agri-Food	45 942	50 109	50 437	58 447	62 094	62 263	35,53
Food industry	26 852	29 472	31 689	32 361	27 347	27 722	3,24
Agriculture, forestry and hunting	16 291	17 790	20 769	23 869	32 373	32 792	46,06
Agricultural Exp. / Total Exp. (%)	7,47	8,88	8,35	8,66	9,21	12,5	

(*Source*: Foreign Exchange Office)

In terms of agricultural season, the 2019/2020 season recorded an export value of 39.4 billion dirhams, an increase of 5% compared to the previous 2018-2019 season. At that time, it accounted for nearly 15% of total national exports.

The majority composition of Moroccan agricultural exports is as follows. It is dominated by tomatoes, followed by citrus fruits and fruit and vegetable products. Most of the exports go to the European Union.

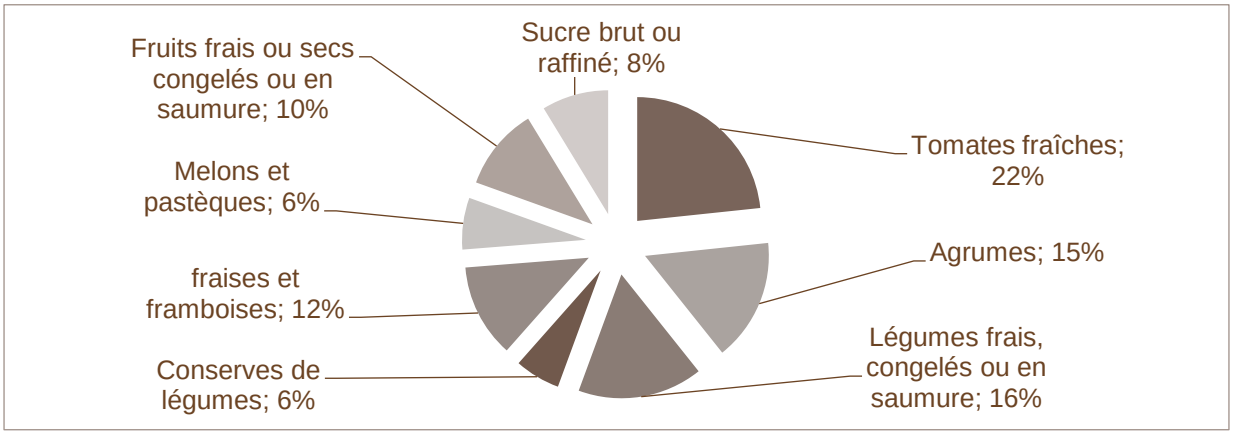


Figure 26: Distribution of Domestic Agricultural Exports by Value by Main Products (%) in Morocco

Imports. Food imports reached 55.2 billion dirhams in 2020 compared to 47.8 billion dirhams in 2019, an increase of more than 15.5%.

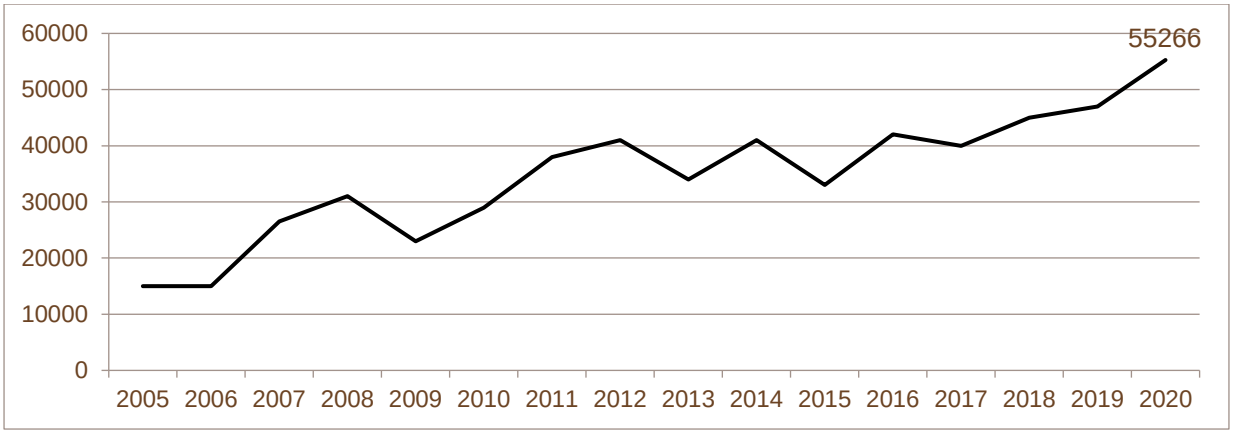


Figure 27: Evolution of imports of agricultural products (in MDH) in Morocco

(*Source*: Office des changes)

The share of wheat by volume in total imports of the main products amounted to 24% in 2020 compared to 19% in 2019. It varies according to the cereal season of the year. The other agricultural products that are positioned at the import level are mainly oilcakes and residues (for animal feed), maize, raw sugar, then tea and dates.

8.2.1.1. Food dependency and the state of coverage of nutritional needs by national production.

With the deployment of the MVP, several products were able to achieve total food self-sufficiency during the decade 2010-2020. These include dairy products, poultry products, red meats, seafood, market garden products, olives and their derivatives, and citrus fruits. For other products, the country has been able to meet a large part of its needs, such as raw sugar (up to 50% self-sufficiency) and fruit products, while other products are still struggling such as oilseed production (for the manufacture of edible oil) and cereals.

Regarding the food trade balance (food in the broad sense), it turned from deficit to surplus from 2015, under the impetus of the PMV strategy. The surplus recorded in 2019 amounted to 8.5 billion dirhams. It decreased to 1.2 billion dirhams in 2020, due to the stagnation in the value of exports and the increase in the value of imports related to the impacts of Covid 19, the poor results of the agricultural season and the increase in import costs. The coverage rate of food imports by exports reached 118% in 2019, before declining to 102% in 2020.

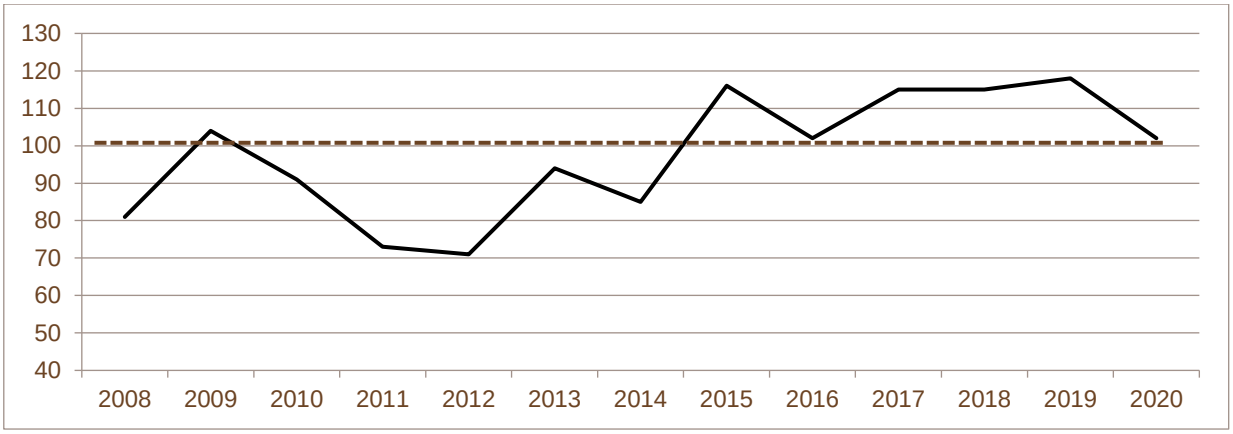


Figure 28: Evolution of the ratio of food imports to exports (%) in Morocco

The MVP has been a green revolution in the space of a decade. However, the climate situation has reduced this growth. Although the productive potential and infrastructure are still in place, the low water input has at times reduced production, resulting in several products for which Morocco considered itself self-sufficient, or even an exporter, put into play.

- Public budget

Since the 2000s, budgets dedicated to the agricultural sector have increased considerably. The operating budget has been kept under control at the level that allows the structures to function. It has increased by 76% in 2 decades, from 2076 to 3662 million dirhams between 2001 and 2022, while the investment budget has increased by 485% during the same period, from 2022 to 11821 million dirhams. The real budgetary leap was recorded in 2008 with the advent of the Green Morocco Plan. As a result, between 2008 and 2022, the Department's capital budget increased more than five times.

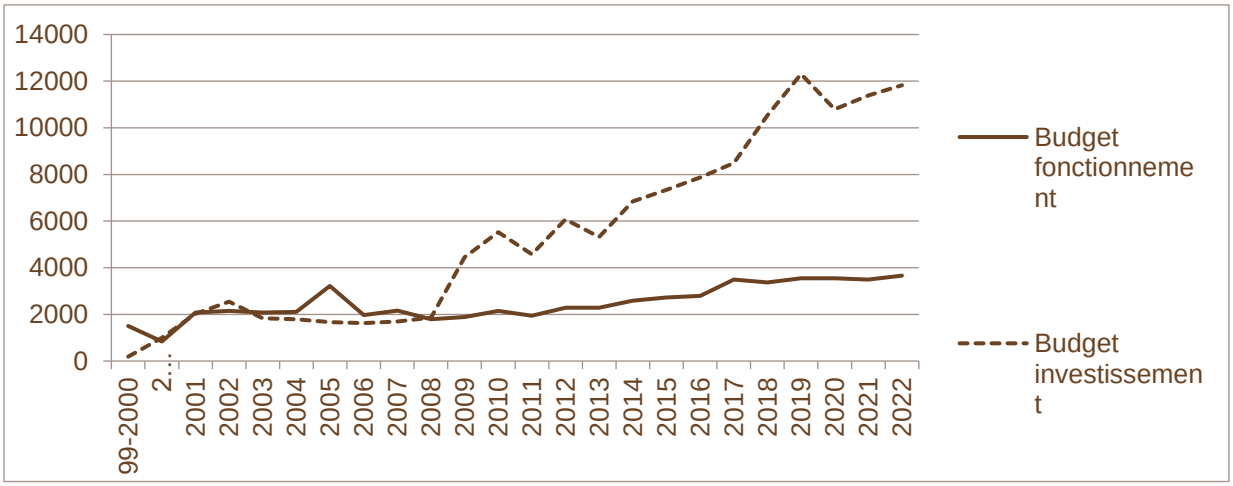


Figure 29: Evolution of the operating and investment budgets of Morocco's Ministry of Agriculture and Maritime Fisheries (in MDH)

(*Source*: Ministry of Economy and Finance)

Funding for the agricultural strategy has not been limited to departmental budgets. It has also been mobilized at the level of the Trust Accounts (CAS), namely the Agricultural Development Fund (ADF) for agriculture, and the Rural Development Fund, for the Rural and Mountain Development Programme. The FDA's budget has

thus increased from 687 to 4000 million dirhams between 2008 and 2022, i.e. a budget increase of 482% between the start of the PMV and 2022. Regarding the FDR, it also increased from 300 to 2250 million dirhams for the same period, reflecting an increase of 650%.

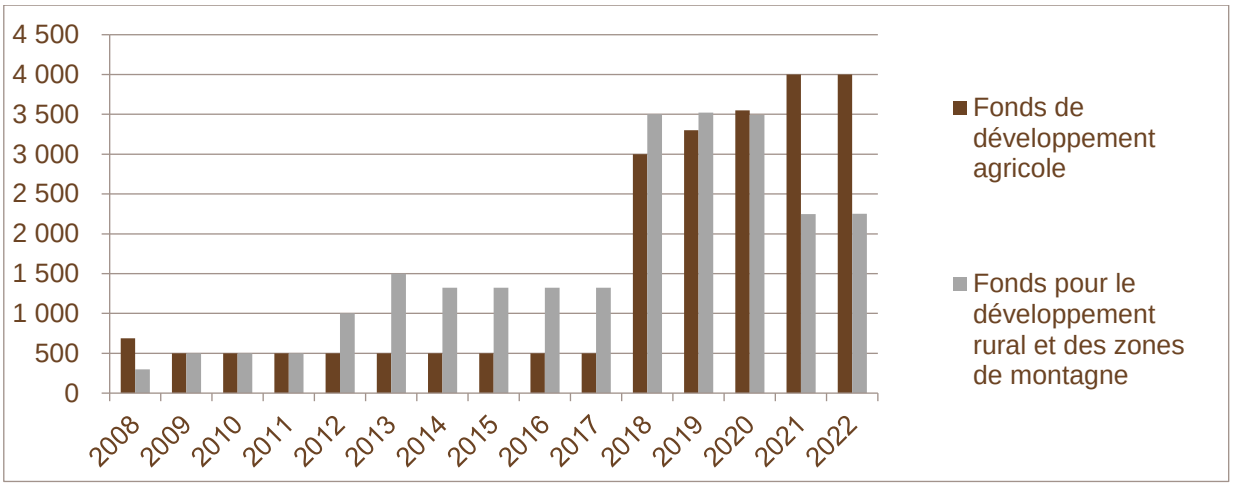


Figure 30: Evolution of Morocco's load ceilings of the CST Agricultural Development Fund (FDA) and Rural Development Fund (FDR) (in MDH)

(*Source*: Ministry of Economy and Finance)

8.2.2. The state of natural resources (total UAA, irrigated). The state of agrarian structures (based on the latest censuses).

- Agricultural areas

Land for agricultural and silvo-pastoral use represents nearly 69% of the total area of the territory. However, a large part of this area is dedicated to rangeland (53 million ha, about a third of which is overgrazed) and forests (9 million ha). The utilised agricultural area (UAA) amounts to 8.8 million hectares, i.e. nearly 18% of the total area of the territory (MAPMDREF, 2018). In 2016, nearly 1.46 million hectares were already irrigated, i.e. more than 16% of the UAA, compared to 1.6% in the 1960s. The rest of the UAA is made up of rainfed agricultural land, so 55% is unfavourable rainfed and 27% is favourable.

Large-scale irrigation schemes and rainfed areas (plains and hills) with an average rainfall of more than 400 mm (known as "favourable Bour") have a relatively high productive potential. These areas account for only one-third of the UAA. They also account for only a quarter of farms and 64% of the country's total irrigated land. They are, in general, well served in terms of socio-economic services and infrastructure and have the assets to compete internationally.

Less favourable areas (semi-arid agricultural plains and plateaus, mountains and steppes, oasis areas) make up the dominant remainder, accounting for 2 thirds of the UAA, 3 quarters of agricultural holdings, and 36% of the irrigated UAA. The majority of these areas correspond to pastoral or agrosilvopastoral areas and to traditional irrigation fed mainly by surface water (through seguias). These areas are subject to multiple constraints, characterized in particular by: (i) low availability of water resources and (often degraded) soils; (ii) inadequate provision of basic socio-economic facilities (roads, water, electricity, etc.); (iii) weak technical

supervision; (iv) high levels of illiteracy and low health coverage; and (v) municipalities with persistently high levels of poverty and vulnerability.

According to the 1996 census, there were 1.5 million farms with an average size of 5.8 ha. Landless farmers and very small farmers (with holdings of less than 3 ha), whose main resource is labour power and extensive livestock, accounted for more than half of farms in Morocco (54%), and held 12% of the UAA and 18% of the irrigated area. The majority of these farms, which used to practice self-subsistence agriculture, are highly vulnerable to drought and even in normal times rely on external income from the farm, such as rural services and remittances from the diaspora. These holdings are concentrated on marginal piedmont and mountain lands, on unfavourable bour and on cleared land in steppe areas and oases.

- Land tenure

In Morocco, there is a multiplicity of land tenure systems whose legal framework is inspired by customary law, positive laws or a reference system combining both tribal and positive law. These land tenure statuses are the result of a complex historical sequence that capitalized on customary rules relating to the collective exploitation of land belonging to tribes, in addition to modern statuses such as melk (individual property).

Most agropastoral land is dominated by collective land, followed by individually owned land, and then forestry. The distribution of land is shown in the following figure.

Collective land according to the official definition, "... are those that collectively belong to a group of inhabitants who are part of the same origin and descend from the same ethnic group". These lands are governed by a series of legislative texts, the most important of which is the Dahir of 1919, which organizes the administrative supervision of these collective assets and regulates their management and disposal.

It should be noted that land configuration has long affected agricultural investment in terms of entrepreneurship commitment and financial investment. These constraints have been lifted following the internalization of the land issue in administrative procedures.

Morocco is currently carrying out one of the largest land reform projects. Several million hectares of land belonging to local authorities will be registered, for the benefit of collectivists, with the stated aim of starting the largest land modernization project in post-independence Morocco. Many collective lands have been melkised as a result. In view of these dynamics, it is difficult to give the exact proportion of each type of land. We will limit ourselves to the proportions referenced in 2008.

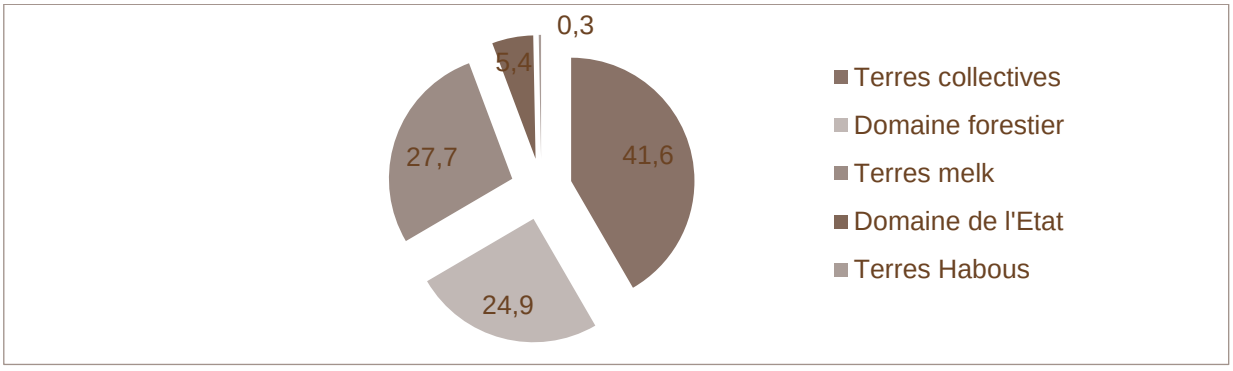


Figure 31: Preponderance of Morocco's Land Status
(*Source*: Rural Affairs Branch documents)

8.2.3. The main agricultural products

In terms of area, agriculture is dominated by cereals, olives, arboriculture, legumes and argan trees. In terms of value added, arboriculture and livestock farming each account for 30% of agricultural value added (below table).

Table 39: Areas and production of agricultural value chains in Morocco

Sectors	Area	Production	Sectors	Area	Production
Crops	Thousands of hectares	Thousands of tons	**Other local crops**	Hectares	Tonnes
Cereal farming	3650	8000	Perfume Rose	950	3900
Legumes	261	1003	Saffron	1865	6,5
Oil	33	39	**Animal production**		Thousands of tons
Sugar crops	67	591	Red meats		606
Olive growing	1073	1414	Milk		2550
Early market gardening	40	2000	Camelina meats		3,6
Arboriculture	377	1570	White meats		782
Citrus farming	128	2400	Eggs (million units)		6900
Date palm	60	102	Honey		8
Argan	146	5,6			
Honey		8			

The below table shows the evolution of the share of each type of agricultural activity in the AAV. It shows that cereal cultivation fell from 15.8% of the AAV to 6.3% between 2014 and 2020, a drop of 60%. This is due both to the drought, which directly affects a predominantly rainfed cereal crop, and to the wave of crop conversion induced by the PMV. The share of fodder and vegetable crops also declined. On the other hand, the share of industrial and tree crops and livestock farming has increased in relative importance in the AAV.

Table 40: Evolution of Morocco's shares of the sectors in the agricultural PV (%)

Crops	2014	2015	2016	2017	2018	2019	2020	Δ 20/19	Δ 20/14
Grain	15,8	20	7,3	18,2	17	9,1	6,3	-30,77	-60,13
Legumes	1,1	1,3	1,5	1,7	1,1	1	1	0	-9,09
C. Forage	3,8	1,7	2,7	1,4	2,6	2,8	2,6	-7,14	-31,58
C. Industrial	1,5	1,3	1,5	0,9	3,3	3,6	3,8	5,56	153,33
C. market gardeners	19,3	14,3	16,8	13,3	14,6	16	6,4	2,50	-66,84
Arboriculture	25,2	28,9	34,7	31,9	23,1	28,2	27,9	-1	10,71
Management and planting	4,3	4,3	4,8	4,3	4,6	5,1	5,6	9,80	30,23
Breeding	28	27,1	30,2	27,2	31,8	32,1	34,1	6,23	21,79
Forests and related services	1	1,1	1,1	1,1	1,9	2,1	2,3	9,52	130,00

AAV	100	100	100	100	100	100	100		

8.2.4. Constraints and challenges

- **Climate Change and Threats**

The year 2022 is the hottest year ever recorded in Morocco. It is one of the 4 driest consecutive years since the 60's while the 2021-2022 agricultural season (hydrological season), is ranked first of the driest seasons since 1981, with a record national rainfall deficit of -46%.

The below Figure shows the evolution of annual rainfall in Morocco. Apart from the distribution of rainfall through the seasons, it appears that the overall rainfall volume during the decade 2013-2022 exceeded the climatological norm level – for the period 1981-2010 – only twice, compared to 7 times for the decade preceding 2003-2012. The very low rainfall level, i.e. below 150 mm, recorded during 2017 and, repeatedly, from 2019 to 2022, was the exception, which occurred only 4 times in 30 years, between 1985 and 2016.

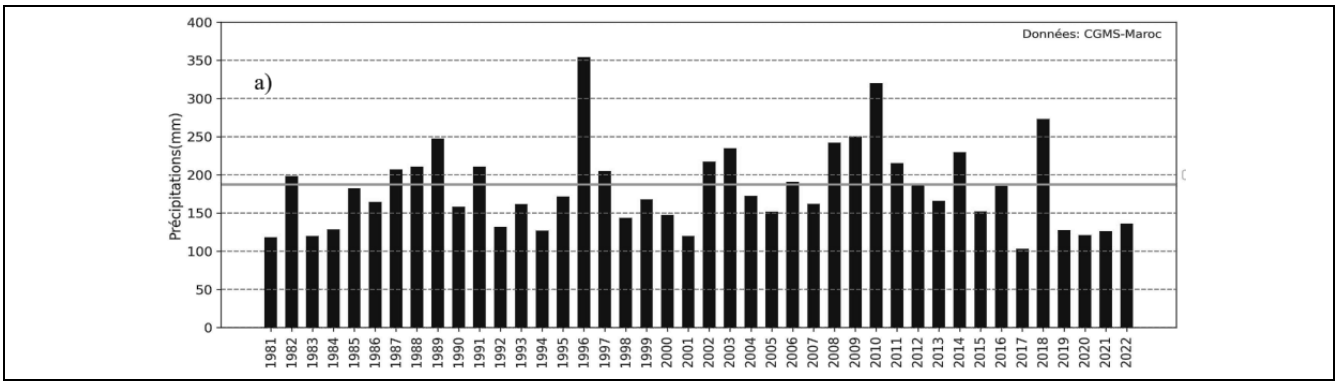


Figure 32: Year-to-date precipitation in Morocco

(*Source*: State of the Climate in 2022, CGMS-Morocco)

The annual average temperature anomaly for the year 2022 is about 1.63°C at the national level compared to the climatological normal calculated over the period 1981-2010. It represents the highest anomaly since 1981, followed by 1.37°C recorded in 2020 and 1.33°C recorded in 2017. The annual average temperatures at the national level in 2022, 2020 and 2017 were, respectively, 20.36°C, 20.1°C and 20.06°C.

With the exception of March, all months recorded average temperatures above climatological norms - the average temperature for the period 1981-2010 - with new monthly mean temperature records in July, October, November and December. 2022 saw 288 days with above-normal average temperatures; That's 80% of the days of the year.

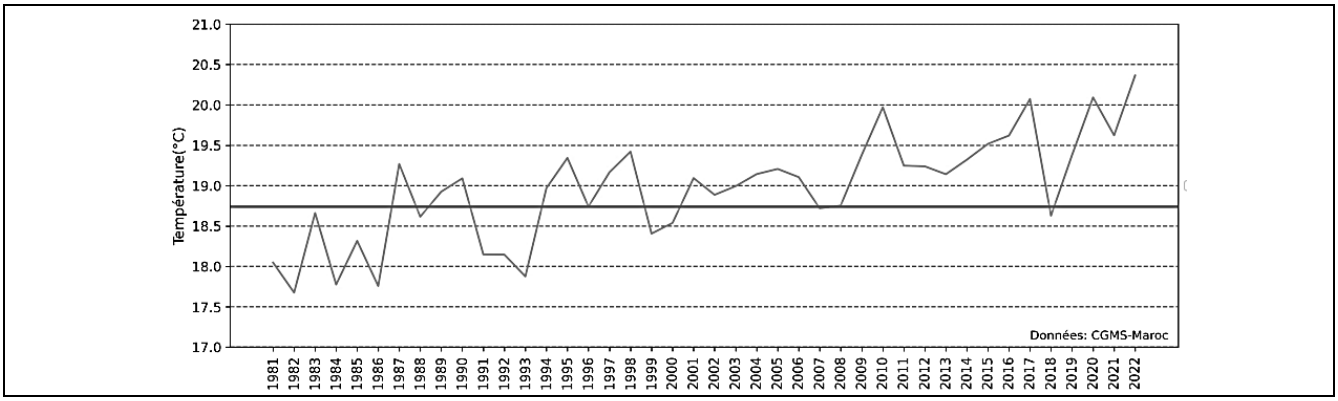


Figure 33: Temporal evolution of Morocco's national annual mean temperature (Tavg)

(*Data source*: State of the climate in 2022, CGMS-Morocco)

Morocco has experienced the occurrence of 25 extreme weather events that have been the subject of warning weather reports. Some of these extreme events have caused damage. Intense weather events in 2022 are distributed as follows: heavy thundershowers (44%), heat waves (20%), snowfall (20%) and strong winds (16%).

8.3. Strategies Adopted

Central Authority: Ministry of Agriculture, Maritime Fisheries, Water and Forestry and Rural Development, and sub-supervisory institutions.

8.3.1. The Agricultural Strategy

8.3.1.1. Definition of the agricultural strategy: GENERATION GREEN: 2020-2030

Morocco's agricultural strategy is set up in synergy with a set of national plans and programmes, including renewable energy development plans, the National Priority Programme for Drinking Water Supply and Irrigation 2020-2027 and the Forest Development Strategy "Forests of Morocco 2020-2030".

Examples of the convergence of vision between strategies include the promotion of entrepreneurship and the generalization of social protection, which are projects that have been revitalized simultaneously at the level of several strategies and action plans, whether they are related to agriculture, the banking sector, the health sector or also industry and trade. These include the TREEA programme in agriculture, "Intelaka" in transversal work, FORSA in crafts and tourism, etc. That said, convergence remains strategic (in terms of orientations) but not regional or territorial, as we will have the opportunity to come back to later.

- Statement of the Green Generation Strategy 2020-2030

This vision capitalizes on the evaluation of the Green Morocco Plan, which has made it possible to identify new angles of intervention. Its novelty lies in the human aspect, which is considered essential for the continuous modernization and self-sustaining growth of the sector.

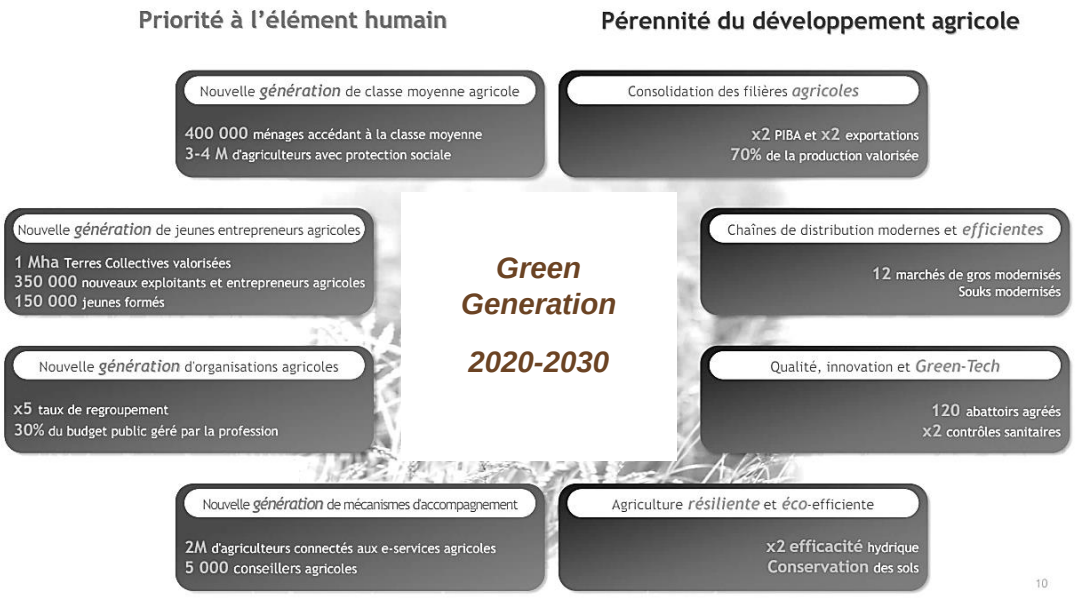


Figure 34: Schematic summary of the axes of Morocco's GG strategy 2020-2030

(*Source*: Official document of the GG strategy, Ministry of Agriculture)

The valorization of the human element refers to the emergence of a new generation of agricultural middle class, allowing 400,000 households to access the middle class and stabilize 690,000 in it, through four pillars. These relate to improving farmers' incomes, the generalisation of agricultural insurance, the establishment of a specific framework for farmers to benefit from social protection services, the reduction of the difference between the legal minimum wage for agriculture (SMAG) and the legal minimum wage for other sectors (SMIG) by 2030 and the birth of a new generation of young entrepreneurs, through the mobilization and development of one million hectares of collective land and the creation of 350,000 jobs for the benefit of young people.

This middle class and these young farmers will also be able to have recourse to a new generation of more innovative agricultural organisations that will make it possible to quintuple the rate of regrouping and strengthen the role of agricultural inter-branch organisations, by promoting new models of cooperatives and strengthening the independence of these inter-branch organisations in the structuring of production chains.

They will also be able to benefit from new support measures, in particular through the strengthening and generalisation of agricultural advice and by connecting at least two million farmers to digital service platforms, as well as by enriching the support system in the field of solidarity agriculture.

The 2nd pillar of this vision is the sustainability of agricultural development, which is also closely linked to the human aspect. It aims to consolidate the achievements of the PMV and to complete its shortcomings, by making a qualitative and technological transition. This will be done through targeted actions on agricultural value chains, distribution chains, quality, innovation, as well as the preservation of natural resources and strengthening the resilience of the sector. Promoting competitiveness and creating wealth are considered essential for economic and social growth.

The vision provides for the consolidation of agricultural sectors, with a view to doubling agricultural GDP to reach 200 to 250 billion dirhams (MMDH) by 2030 and doubling the value of Moroccan exports to reach 50 to 60 billion dirhams, as well as the improvement of distribution chains, in particular through the modernization of 12 wholesale markets and souks. in partnership with the Ministry of the Interior and local authorities.

It is also about the development of resilient and sustainable agriculture through the application of the irrigation water component, which is part of the national drinking water supply and irrigation programme 2020-2027, and the support of farmers in the transition to renewable energy and the improvement of soil conservation techniques, as well as the improvement of quality and innovation capacity, by granting approval to 120 modern slaughterhouses and doubling health controls to comply with international standards and meet the needs of consumers.

About Agroecology

Meeting the ecological challenge in the green dimension of the strategy, while seeking to develop resilient and sustainable agriculture, requires a transformation of the productive and even social organization and can only succeed if it is embodied by the farmers themselves, argued some economists such as Abdelghani Youmni, a specialist in public policies in the countries of the Southern and Eastern Mediterranean (SEMCs). Thus, farmers will have to be in agroecological transition to learn how to irrigate better, use fertilizers better and make better use of renewable energies.

The GG 2020-2030 in a few axes: Consolidation of the achievements of the Green Morocco Plan Strategy for the Conservation and Development of Genetic Resources of Cultivated Plants National Irrigation Water Saving Program Strategy for the Development of Rural and Mountain Areas Strategy for the Development of the Oasis Zones and the Argan Tree National Programme for the Development of Rangelands and the Regulation of Transhumant Flows TREEA programme: revitalisation of rural areas Programme to rehabilitate 150,000 ha of PMH areas by 2030 Innovative public-private partnership projects, such as the Water Desalination and Irrigation Safeguard Programs Programme to extend irrigation downstream of dams Multi-risk climate insurance Initiative Al Moutmir Comprehensive climate insurance

8.3.1.2. Key climate change adaptation measures adopted

8.3.1.2.1. Example of CC Adaptation Projects

The programme for the revitalisation of Moroccan rural territories through employment and entrepreneurship in the agricultural and para-agricultural sector (TREEA)

The programme aims to revitalise rural areas through employment and local economic initiatives. It is spread over 6 years and targets 3 regions of Morocco: the East, Dès-Meknes and Souss-Massa. The financing of this program, which totals €384.8 million, is divided into 3 levels: 1/ budget support at the national level by AFD and the World Bank, 2/ financing of investment and delivery projects at the regional level by AFD and the EU, and 3/ financing of technical assistance to institutional and local actors by the EU and AFD.

The objective of the program is broken down into 3 areas of intervention: 1/ the development of support ecosystems for production organizations and entrepreneurs, 2/ the development of modern infrastructures and 3/ the strengthening of the institutional environment. It aims to consecrate new areas of competence for central and local agricultural agents, which are 1/ rural entrepreneurship and 2/ the practice of agroecology as a resilience tool that integrates the new climatic conditions. The spectrum of beneficiaries covered by the programme are family farms (EFAs), professional agricultural organisations (OPA), very small enterprises (VSEs), project leaders, young people, housewives, and neets.

Regarding agroecology, the programme aims to promote a new approach to EFA production systems centred on agroecological and/or organic practices aimed at adapting to climate change, improving the quality of production, improving the value of production and supporting takeover bids to improve market outlets for this type of production.

The missions of technical assistance (TA), which has a central role to play, include:

- Support for the identification and formulation of interventions in the territories according to the axes of the program and its approaches (Gender, E&S Risk Management, adaptation to CC).
- Support for the overall management of the project through coordination between different levels of the project owner and dialogue with institutional partners, particularly regional partners (CRI, ODCO, ANAPEC, OFPPT); programming, budgeting, monitoring of procurement; and monitoring and evaluation, reporting to AFD,...
- Methodological and technical support for the implementation of interventions in the field: • support for the transformation of EFAs' agricultural practices towards AGROECOLOGY and ORGANIC, • professionalization of takeover bids and VSEs, • support for entrepreneurship and employability, • development of territorial value chains, 4. Implementation of the program's communication and visibility plan, 5. Training of staff involved in various themes related to the programme's interventions

Solidarity projects related to pastoral rehabilitation

So-called solidarity projects are collective projects that consist of setting up facilities for village collectives. Most of these projects focus on pastoral and agro-pastoral rehabilitation. These projects are different in that they are not part of the agricultural intensification usually assimilated to the MVP, but they create an environment

conducive to a return to climate-resilient agropastoral systems. These projects are all the more important in a context where the collective lands that were once used as rangelands are for the most part distributed and exploited individually, or even "melkized" (a major project recently launched that consists of transforming the collective land giving the right of usufruct, used by the tribes according to customary law, into parcels of individual property, on a permanent basis). The rehabilitation of rangelands makes it possible to partially compensate for the reduction of rangeland in favour of agriculture and to rebuild the basis for a forced return to extensive systems that are not very productive and resilient to climate change.

The Climate Change Adaptation in Oasis Areas Project (PACCZO)

The Climate Change Adaptation in Oasis Areas (PACCZO) project consists of the rehabilitation of ancestral irrigation systems, the establishment of new sustainable development of hydraulic structures and the support of local initiatives for the benefit of young people and women in the agriculture, tourism and handicrafts sectors.

The project focuses on two basins that are particularly vulnerable to climate change, in the Draa-Tafilalet region, presenting different and representative issues in the area, particularly with regard to water:

- Gheris Basin: An area located in the middle part of a watershed where water resources can still be mobilized to safeguard palm groves with agricultural production potential.
- Maïder basin: an area located downstream of a catchment area where the availability of water resources must be preserved to ensure the supply of drinking water.

Funded by the Adaptation Fund, through ADA accreditation, with a grant of approximately USD 9.97 million, this project is spread over 5 years and benefits 40,000 people. Implemented by ADA and executed by ANDZOA with the support of the ORMVA of Tafilalet, this project has different partners: ministries, administrations and agencies, private sector and professional organizations. Its overall objective is to improve the adaptive capacity of populations in oasis areas to the impacts of climate change. The specific objectives are:

- Improving the adaptive capacity of the water sector;
- Diversify sources of income and improve the living conditions of populations vulnerable to climate change in target areas;
- Improve ecosystem resilience in response to climate change and variability;
- Improve the awareness of all stakeholders through knowledge management and sharing;
- Build the capacity of participants in the design and implementation of adaptation measures.

As for the impact of the actions carried out, it was felt on several levels:

- Rise in the water table by 17 m/soil;
- Improvement in the efficiency of water distribution, recording a water productivity of around 4.7 DH/m3, i.e. an improvement of 20%;
- Securing drinking water and increasing the irrigated area by 395 ha;
- Raising awareness among the population and stakeholders;
- Increase in PV of crop production per additional hectare by 42%.

Other projects targeting climate change issues are:

- Climate Change Adaptation Project for Maghreb Agriculture (ACCAGRIMAG, FFEM/AFD Funding): project to reduce climate risk by securing income and adapting cultivation practices.
  Partners: MAPMDREF, DRA Fez-Meknes, INRA, DSS, DMN, IAV Hassan II and international institutions.
- MOSAICC project: Development of a collaborative tool to assess the impact of climate change on agriculture.
  Partners: INRA, DSS, DMN, IAV Hassan II, EFI, DRPE, HCEFLCD, ABH.
- FREECLIMB project implemented in the framework of the Partnership for Research and Innovation in the Mediterranean Basin (PRIMA): scientific initiative whose objective is to improve the resilience to climate change and the sustainability of fruit growing (olive, almond, peach, apricot, vine and citrus). INRA partners, including Meknes.
- Territorial Plan to Combat Global Warming, Souss Massa Region
  Partners: Secretariat of State for Water, Mines and Sustainable Development, Souss Massa Region, GIZ.

8.3.1.2.2. Policies, strategies, programmes, plans and actions for strengthening the resilience of the agriculture sector and adapting to climate change

The problem of climate change related to GHG emissions is global in scope and requires global action to mitigate it. Although Morocco is considered at the global level as a low GHG emitter, it has been part of the international movement to fight climate change, notably through the ratification of the Paris Agreement and the presentation of its Nationally Determined Contribution (NDC) with GHG emission mitigation and climate change adaptation objectives by 2030. Morocco has designed a portfolio of mitigation measures comprising 55 measures, 14 of which relate to the agricultural sector and mainly relate to fruit tree planting programmes.

Table 41: Morocco's NDC commitments for SAG mitigation – agriculture stream

Measure	Description	Mitigation (Gg CO2)		Cost (U$ millions)
		2030-2030	2030	
Olive Growing Program (Tranche 1)	Planting of 447,000 ha of olive trees in areas unsuitable for annual crops, in order to combat soil erosion and improve the incomes of small farmers.	11719,5	1069,8	1209,5
Fruit Growing Program (Tranche 1)	Planting of fruit trees on 160,000 ha in order to improve and diversify farmers' incomes, especially in fragile mountain areas.	11907,6	1087,0	753,0
Citrus program (tranche 1)	Citrus plantation on 45,000 ha (density of 600 plants/ha) to improve farmers' income and export earnings.	1439,5	131,4	450,0
Date Palm Program (Tranche 1)	Planting of 3 million date palms to improve the productivity of oases and combat desertification and rural exodus of young people	768,2	70,1	353,0

National Programme for the Development of Rangelands and the Regulation of Transhumant Flows – Tranche 1	Development of rangelands in order to combat desertification in the country, improve the income of livestock farmers and protect biodiversity (planting of 14,500 ha of fodder shrubs).	4233,6	386,5	70,0
Cactus Planting Program (Tranche 1)	Revegetation of bare or eroded land through the planting of 44,000 ha of cacti in drylands, leading to improved incomes for smallholder farmers and women's cooperatives.	2394,1	218,5	31,1
Olive Growing Program (Tranche 2)	Extension of the olive growing programme to 300,000 ha	3480,0	661,2	812,1
Fruit Growing Program (Tranche 2)	Extension of the arboriculture programme to 400,000 ha.	13521,9	2569,2	917,9
Date palm program (tranche 2)	Extension of the date palm program to 2 million plants.	233,4	44,3	236,0
National Programme for the Development of Rangelands and the Regulation of Transhumant Flows – Tranche 2	Extension of the national programme for the development of rangelands and the regulation of transhumant flows over 300,000 ha.	2961,7	562,7	60,0
Cactus Planting Program (Tranche 2)	Extension of the cactus planting programme to 85,150 ha.	2095,5	398,1	60,5
Argan Tree Planting Program	Extension of plantations to 49,300 ha.	1158,4	220,1	145,3
40 MW Dakhla Wind Farm	Installation of a wind farm with a capacity of 40 MW to supply energy to the Dakhla seawater desalination plant.	1521,7	156,9	200,0
Total agriculture		57435,1	7576,0	5298,4

8.3.1.3. The main measures adopted to preserve natural resources (land, water and biodiversity)

8.3.1.3.1. Development and Resilience Programs

- The Programme for the Development of Argan Cultivation in Vulnerable Areas (DARED)

This program aims to preserve the argan tree, an ecological symbol of the Moroccan terroir and a world heritage, through reforestation projects in the argan park and domestication projects as a cultivable agricultural species. The argan tree proved to be a delicate species to reproduce in the nursery and its rendering was somewhat random. After several years of trials, research has made it possible to control its reproduction in order to reforest forests and encourage investment in argan cultivation. As an agricultural speculation, the argan tree offers the ecological advantage of being resilient, requiring very little water, and in perfect symbiosis with its ecosystem.

- The seawater desalination programme to safeguard the Chtouka aquifer

Morocco has started several seawater desalination projects, intended for both drinking water production and agriculture. Seawater desalination is both criticized for its impact on the environment, and applauded for the solution it offers to deal with the major water shortages that are predicted for the coming years. In this context, desalination is envisaged to alleviate the pressure on certain groundwater tables that have reached a very critical level, such as the one in Chtouka.

The Climate Change Irrigated Agriculture Adaptation Program downstream of the Kaddoussa Dam for the Irrigation and Preservation of the Boudnib Palm Grove in Errachidia Province (PDIAAICC). This program consists of mobilizing water in a rational way through localized irrigation to preserve the agroecological heritage of the Boudnib palm grove located in the eastern center of Morocco.

- Strengthened innovation systems for resilient and climate-smart agriculture

These are measures that improve the efficiency and effectiveness of production systems (inclusive and sustainable development of agricultural and rural areas through PMH, improvement of efficient production systems and agricultural support services (agricultural advice, institutional and sectoral capacity building, structuring of farmers' fabric, plant health protection, training, etc.). ...) and to strengthen the resilience of Moroccan agriculture in the face of climate change (digitalization of agriculture, support for eco-efficient and climate-resilient agriculture, preservation of the environment and natural resources).

The integration of environmental sustainability and natural resources into action programmes would benefit all local actors, including small-scale family farming.

8.3.1.3.2. Mitigating the impact of climate change

To mitigate the effects of climate change, the agricultural strategy is in line with Morocco's climate change policy and the National Sustainable Development Strategy. It has adopted two key components, namely climate change adaptation and GHG mitigation. The adaptation effort focused mainly on the control of irrigation water, while the mitigation effort concerned in particular the extension of plantations, in particular the most water-efficient and those adapted to the possibility of rainfed management, to increase the potential for carbon sequestration, oxygenate the atmosphere and reduce GHG emissions.

The programme contracts cover a total of 19 sectors, 15 of which are plant-based, namely olive growing, arboriculture, citrus fruits, date palm, cereals and legumes, sugar crops, oilseeds, market gardening, argan trees, seeds, organic sector, red fruits, saffron, rice and perfume roses.

A large part of these value chains play an implicitly agroecological role. These include sectors that aim to preserve biodiversity and agroecological terroir heritage (argan tree, saffron and perfume rose), and arboreal sectors that play a role in terms of carbon sequestration. Lately, we are encouraging the adoption of crops that offer an interesting eco-economic effect, such as the carob tree, as a substitute for the avocado tree.

- Irrigation Water Management and Management Programs

For the period of the PMV in this case, the plantations carried out under Pillar II and the programme contracts for the olive, citrus, phoenicicultural and arboreal sectors covered an area of nearly 490,000 ha between 2008

and 2019, exceeding the PMV objective of planting 12 million trees per year, and thus increasing the potential for annual CO2 sequestration of the total orchard by more than 33% agricultural.

The MVP had placed a strong emphasis on the mobilization and rationalization of irrigation water in order to improve agricultural production and productivity at a lower water cost. In terms of agroecology, these programmes have first made it possible to "convert" inefficient irrigation systems into much more economical systems. It has also made it possible to mobilize water in initially rainfed systems, which has increased pressure on water stocks and met food and socio-economic needs. This policy is based on three structuring irrigation programmes

- The National Irrigation Water Saving Program (PNEEI)

This program aims to develop localized irrigation in order to improve the efficiency of irrigation water use in agriculture. This program has made it possible to save and recover more than 1.6 billion m3 annually in terms of water savings. The area irrigated by drip irrigation has thus increased from 9% of the area under irrigation in 2008 to 37% in 2019. The conversion from gravity and sprinkler irrigation to localized irrigation – which saves water and energy – has led to a 50% reduction in groundwater pumping as well as savings of 40% in water resources used.

- The Irrigation Extension Program (EIP)

The objective of this programme is to create new perimeters and strengthen the irrigation of existing perimeters dominated by the dams built or planned, in order to remedy the undervaluation of nearly 1.2 billion m3 of water mobilized by the dams intended for irrigation.

- The Public-Private Partnership (PPP) Program

In the field of irrigation, it aims to improve the technical, economic and financial conditions for the management of irrigation water services in the perimeters. This program consists of preserving the water table by mobilizing non-conventional water through various projects including irrigation conservation projects and seawater desalination projects. At the end of 2019, 4 irrigation PPP projects were contracted, including two seawater desalination projects for the irrigation of Chtouka-Ait Baha and Dakhla (totalling 20,000 ha).

- New organic areas

The organic sector is a manifestation of agroecology par excellence. It consists of producing without the use of fertilizers or chemical treatments. The main species grown organically in Morocco are mainly olive trees, almond trees, aromatic and medicinal plants (PAM), citrus fruits and vegetable crops. In addition to spontaneous harvesting, 12,000 ha of cultivated land is reserved for organic farming, for a total production of about 120,000 tons. Nearly 80% of the cultivated area is divided between 5 main production regions: Fez-Meknes, Marrakech-Safi, Souss-Massa, Casablanca-Settat and Rabat-Salé-Kenitra. For spontaneous harvesting, the main species concerned are argan trees, MAPs, carob trees, prickly pears and capers. Between 2010 and 2019, the area sown as well as the overall production tripled.

8.3.1.3.3. The Strategy for the Development of Oasis Areas and the Argan Tree (2012-2020)

This strategy is led by ANDZOA, a Moroccan public institution under the supervision of the State. It intervenes at the level of oasis zones located in the Saharan and pre-Saharan regions of the country as well as the geographical areas where the argan tree extends.

ANDZOA's mission is to conduct integrated territorial development in its areas of action that is not limited to agricultural development, but which is interested in the revitalization and attractiveness of rural territories, in terms of human development as a whole, considering the reduction of poverty, the promotion of ecotourism, crafts, the preservation of biodiversity, the promotion of the terroir, etc. It is therefore a territorial mandate instead of a sectoral mandate where resilience, sustainability and development are considered simultaneously. The specificity of oasis and Saharan areas de facto requires a treatment that is eco-sensitive to the conditions of this particular environment, and therefore of an intrinsically agroecological consideration.

For example, this strategy has manifested itself in particular through the rehabilitation of argan forests as well as the densification of the traditional palm grove. This example is a combination of silvo-agricultural development and ecological preservation. ANDZOA also carries out soil preservation programmes (improvement of land use and management patterns and vegetation cover, restoration and protection of forest areas, etc.) as well as biodiversity preservation programmes (protection of biosphere reserves, supervision of the urbanisation of oases, etc.). Another area of development concerns the competitiveness of territories whose economies are based on the development of their natural and cultural resources so that they directly benefit the local population.

Three sectors are primarily addressed, including agriculture (and argane) and rural tourism, mainly through the structuring of the network of actors and their support in the design and development of income-generating activities (IGAs) based on the development of local resources. Several levers are implicitly agroecological, since the development of IGAs hijacks the peasant framework based on agricultural intensification, and thus reduces the pressure on the exploitation of natural resources.

8.3.1.3.4. Conservation Agriculture: Al Moutmir Initiative (2018-2030)

- Al Moutmir no-till

This initiative is led by UM6P, a Moroccan higher education institution focused on applied research and innovation. It also involves the OCP and the MAPMDREF. The Al Moutmir initiative aims to promote conservation agriculture. It is also part of the national no-till programme aimed at reaching 1 million hectares by 2030. For the year 2023, this program aims to achieve more than 11 thousand additional hectares, bringing the total area cultivated in direct seeding mode to more than 36 thousand hectares by this date.

This mobilization is accompanied by a local monitoring program provided by the Al Moutmir team on site, which includes soil analyses, the implementation of demonstration platforms, as well as agronomic and technical training.

- The Smart Blender, a tailor-made and local fertilizer offer

At the end of 2018, Al Moutmir introduced the Smart Blender technology to support the optimization of natural resources and the proper use of minerals (macro and micro nutrients). This technology consists of manufacturing tailor-made fertilizers adapted to each agricultural plot based on its own soil analyses. This solution helps farmers use only the amount of fertilizer they technically need, reducing waste, reducing environmental impact, and improving productivity while consuming fewer resources. The deployment of Smart Blender production units in partnership with fertilizer manufacturer-distributor partners and national aggregators has now enabled the production of tailor-made fertilizers at the level of local units based as close as possible to farmers in different provinces.

- SoilOptix, for finer soil mapping

In addition to the soil analyses carried out at the mobile laboratory level, Al Moutmir introduced the SoilOptix technology in 2019, which aims to contribute to the development of smart and more resilient agriculture.

SoilOptix is a technology used for mapping the physical and chemical properties of soil. The method is based on measurements of gamma (natural) radiation, and more specifically of naturally occurring radioactive elements in the soil. Used in combination with soil testing, the SoilOptix measures and maps the physicochemical properties of soils to represent more than 134 points per hectare. It thus makes it possible to obtain more data points, more definition as well as more detailed soil maps with a dual objective of improving yield and optimizing the use of inputs.

8.3.2. The Forestry Strategy

Central leader: High Commission for Water and Forests and the Fight against Desertification

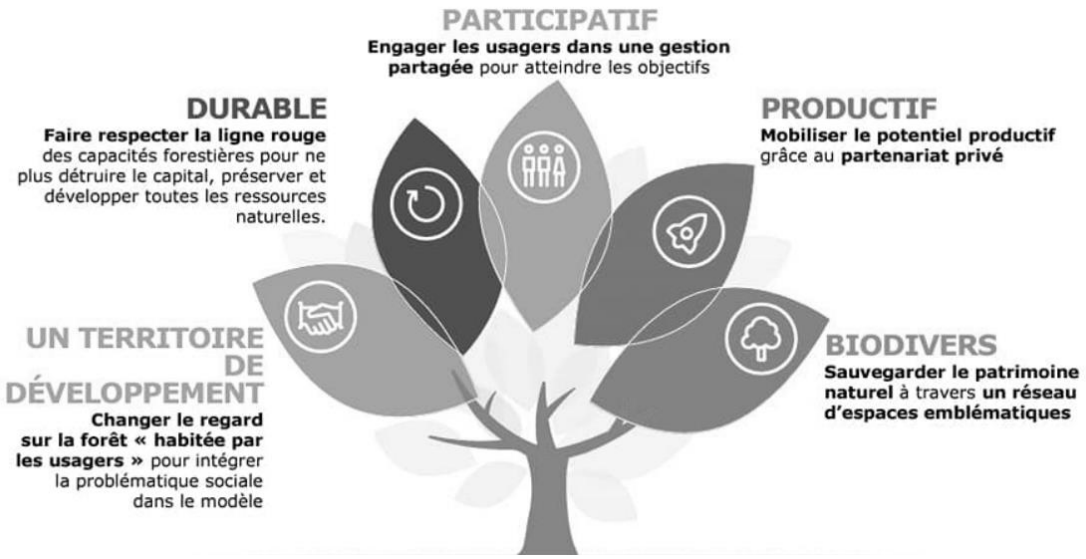
8.3.2.1. Definition of the forest strategy: FORESTS OF MOROCCO 2020-2030

8.3.2.1.1. Strategic Directions

Morocco's Forest Strategy 2020-2030 aims to meet the objectives of halting deforestation and aims to recover 30 years of forest degradation and make the forestry sector more assertive and modern. It was based on a diagnosis of a strong degradation by 2050, namely the acceleration of 50% of the degradation of forest cover (environmental function), a loss of the equivalent of 5 billion dirhams per year in terms of additional potential value (economic function of the forest), the increase of 300 million dirhams/year in the import value of timber and industry and the increasing precariousness of populations in forest areas.

On this basis, Morocco's Forest Strategy 2020-2030 proclaims an inclusive, sustainable and wealth-creating management model that reconciles the people and the forest, addresses all its social, economic and environmental functions, and is part of the long term to benefit all generations. The 5 orientations of the strategy are: 1/ the territoriality of development, which calls for a view of the forest as a space "inhabited by users", 2/ sustainability which refers to the definition of the balance and regeneration capacities of the forest and its resources, 3/ the participatory approach aimed at engaging forest users in a collective participatory management of their living space, 4/ Productivity by mobilizing the productive potential of the forest through

partnership with the private sector, and 5/ Biodiversity, which concerns the safeguarding of the natural, biological and genetic heritage through a network of emblematic spaces.



8.3.2.1.2. Areas of intervention

In line with its orientations, the 4 fundamental areas of intervention are established as follows:

1/ Reinventing and structuring the participatory approach: The first axis focuses on the creation of a new model based on a participatory approach, with the population as the first partner in its management. This involves the creation of more than 200 local forest development organizations, the contracting with users for the participatory protection of the 50,000 hectares of trees planned to be planted annually, the creation of a new body of more than 500 territorial animators to play a mediation role with the local population, in addition to the promotion of hunting leases to associations and companies according to the specifications.

2/ Differentiate and develop areas according to their vocations: The second axis concerns the management and development of forest areas according to their vocation by encouraging private investment on an area of 120,000 hectares of eucalyptus and pine, with a strict identification of the social obligations of private actors, as well as the development and enhancement of the network of ten national parks to initiate the development of a prosperous ecotourism sector.

3/ Invest and modernize the core business: The third axis focuses on the development and modernization of forestry professions by creating modern forest nurseries with modern specifications in partnership with the private sector. This is done while ensuring that the genetic character of national forests is preserved. The digitization of the sector's management resources, the modernization and development of forestry technical pathways are also among the levers chosen.

4/ Rebuilding the institution: The fourth axis concerns the institutional reform of the sector through the creation of the Water and Forests Agency, which will be in charge of the sovereign management of the State's private forest domain outside the national parks, and the Nature Conservation Agency which will be in charge of the management of the different areas of the national parks. It will also focus on the adequacy of the legal framework

and the qualification of human resources according to the specificities of the professions and the creation of a training and research centre.

The targets set for 2030 are as follows:

- In terms of sustainable management (organisation of the population and participatory management):

➢ Organization of populations in partner solidarity structures with an unconditional objective of 300 civil society organizations (CSOs), i.e. associations and cooperatives, serving as support structures for sustainable forest management;

➢ Participatory management and improvement of benefits for local populations with an unconditional objective of 200 forest development organizations (FDOs) serving as support structures for sustainable forest management.

- Strengthening the resilience of socio-ecosystems in vulnerable areas (mountainous areas, deserts and coastal dunes):

➢ Watershed management, gullies and improvement of population benefits through erosion control measures to achieve the target of 1,500,000 ha in 22 priority basins (2015-2030);

➢ Opening up vulnerable populations by opening runways with a target of 240 km/year (unconditional) and 60 km/year (conditional).

8.3.2.1.3. Key levers

The main levers of action relate to reforestation, defence, participatory social animation and the deployment of forest development organizations. The strategy aims to reforest between 50,000 and 100,000 hectares in the long term with a success rate of 80%, promote defence through a financial incentive of 1,000 DH/ha, carry out nearly 500 social activities at the rate of one activity per municipality, and deploy nearly 200 forestry organizations. These levers should make it possible to make up for 30 years of degradation through the recovery of 133,000 ha of forests, increase by 50% direct jobs in the participatory forest, the productive sector and the tourism sector, and double the annual market value from 2 to 5 billion dirhams through the productive and ecotourism sectors.

8.3.2.2. The main measures adopted to preserve natural resources (land, water and biodiversity)

Morocco's Forests Strategy 2020-2030 includes several measures relating to natural preservation that have either a direct or indirect effect. As an example of indirect measures, participatory social management makes it possible to bring out social appropriation and territorial compromises for the preservation and sustainable use of the forest. The breakdown of the said 4 strategic axes is as follows:

Table 42: Description of the content of the axes of Morocco's Forest Strategy 2020-2030

Indicator	Wording	Description

1/ Reinventing and structuring the participatory approach		
>200 forestry organizations	Promoting local structures	-Organize forest users in an inclusive way starting from the traditional fabric (tribe, fraction, nouabs, etc.) so that they become actors in forest management. - Implement the establishment of forest development organizations (ODFs) that will bring together users and organize forestry activity at the municipal level.
500 social workers	Create a social animation body	-Capitalizing on successful experiences, create a corps of 500 E&F social workers deployed on the ground in forest communes to establish dialogue with the population, catalyze participation in forestry activities and mediate with the authorities.
Defensible Spaces	Leading the participatory protection of reforestation	- Involve the population in the choice of species. -Quadruple the amount of compensation from 250 to 1000 Dh/ha/year - Contractualize the fencing through the ODFs
Specific participation contracts	Participatory productive and asset management	-Productive forest: adapting the participatory approach to a concession model with social obligations guaranteeing benefits greater than rights of use - Heritage forest: engage in a "Park" territorial logic and compensate for the conservation constraint by strong technical support for the population (financing of the label)
Hunting Enthusiasts	Promoting hunting grounds	- Promote hunting leases to associations and companies according to the specifications
2/ Differentiate and develop spaces according to their vocations		
120,000 ha of productive forest	Developing productive partnerships with forest concessions	-Eucalyptus: conceding 100,000 ha already planted in favourable areas as part of the development of an integrated biomass energy industrial sector. -Pine: concede 20,000 productive ha on the Atlantic coast, reduce imports to ensure better integration of the sector.
Private-led R&D	Organising the transfer of competence from the public-private partnership	- Capitalize on concessional experience to build its own know-how in participatory forestry through a technical transfer on the management of nurseries, the silviculture of artificial species and the participation of users.
Investing in scientific tools	Conserving biodiversity	-Build the national biodiversity monitoring system. -Implement national conservation plans for endangered species. - Provide continuous training in nature conservation professions. -Continue the fight against desertification.
1 million ecotourists (2030) and 10 national parks)	Investing to get the ecotourism sector off the ground	-Enhance the network of 10 national parks and initiate the ecotourism sector - Develop the "heart offer" for each park + label the activities
3/ Invest in and modernize the core business		
1 modern public nursery	Professionalizing the seed-nursery field	- Consolidate public management of seeds, a critical link in the forest chain that determines the success of reforestation and the genetic traceability of heritage.

		-Securing the need for native forest seedlings through the creation of a completely modernized public nursery. - Mobilize private investment for other species (calls for projects).
Digital Forestry in the Field	Leading the digital transformation of the core business	- Digitize 100% of landscaping and management plants -Digitize the observation of forest cover using the latest national technologies (M6 satellite).
Technical capitalization	Modernizing the technical approach	-Install control plots in reforestation perimeters and key ecosystems. • Capitalize on technical data to improve/adjust itineraries • Clarify relationships with subcontractors
Investing in working conditions	Improving working conditions	• Provide staff with the necessary means to mobilize them in the field. - Infrastructure: renewal of forest houses. Equipment: systematic provision of means of locomotion to field teams (surveillance and social animation), and modern means of communication.
4/ Rebuilding the institution		
2 separate agencies	Structuring the institution into agencies	- Create the Water and Forests Agency to manage the multifunctional forest domain (including concessions), taking into account the sovereign role of the State. -As a target, create the Nature Conservation Agency to manage the National Parks (then extension to other protected areas).
New Forestry Law	Adapting the legal framework	Amend the 1976 Dahir (introduction of ODFs, communal forest council, regional body). Adapt the market framework to the realities of the business (biological asset). - Publish the decrees implementing the law on protected areas.
3 differentiated professions	Transforming HR	- Distinguish forestry personnel by profession (supervision, technical and animation) to improve performance, avoid conflict of interest and enhance the image of the forester. - Adapt the HR status to the new institutional organization and the specificities of the professions (night work, interventions, etc.) - Supporting the institutional transition through change management.
1 integrated training and research centre	Create an F&R hub	-Bring ENFI/ITREF closer to E&F and CRF to create synergies between training, business and research, by proposing a realistic evolution. • Increase the skills of the workforce on new pedagogical content and new tools.

The ecologically sensitive policies, strategies, programmes, plans and actions that accompany Morocco's Forest Strategy 2020-2030 and promote the resilience of the sector and adaptation to climate change are as follows:

Wood Energy Strategy; National Strategy for Monitoring and Monitoring Forest Health; Strategy for Urban and Peri-urban Forests; Forest Fire Master Plan;

Reforestation Master Plan; National Forestry Program; National Action Programme to Combat Desertification; National Watershed Management Plan; Protected Areas Master Plan; National Strategy for the Development of the Aromatic and Medicinal Plants Sector; Morocco's National Biodiversity Strategy and Action Plan; Strategic Action Plan for the Conservation of Marine and Coastal Biodiversity in the Mediterranean.

8.3.2.3. Key climate change adaptation measures adopted

According to Morocco's 2021 Nationally Determined Contribution report, the contribution of these interventions, broken down into 7 measures, should result in a carbon footprint and a significant reduction in GAS emissions of around 17624 Gg CO2 during the period 2020-2030, with a target of 2554 Gg CO2 by 2030. The breakdown of the contribution of these measures is as follows.

Table 43: Morocco's NDC commitments for SAG mitigation – forestry component

Measure	Description	Attenuation (Gg CO_2)		Cost (U$ millions)
		2030-2030	2030	
Ecosystem restoration activities (unconditional part).	A1: Restorative activities involving biological reforestation and regeneration (50,000 ha per year) A2: Distribution of forest plants (6,000,000 plants per year).	6613,4	1194,0	593,0
Degradation avoided (unconditional part).	B1: Compensation for defence (90,000 ha per year); B2: Energy efficiency through the distribution of improved kilns (6000 kilns per year); B3: Better fire risk management including opening and maintenance of fire trenches (500 km per year); development of 65 water points per year; monitoring during periods of high sensitivity (1245 lookouts per year); Follow-up and diagnosis (900 observations per year).	873,1	130,6	257,3
Strengthening the resilience of socio-ecosystems in vulnerable areas (unconditional part).	D1: Establishment of maritime and continental dunes (800 ha per year).	16,6	3,0	697,6
Activities between 2010 and 2020		6529,6	590,9	541,6
Ecosystem Restoration Activities (Conditional Part).	A1: Restorative activities involving biological reforestation and regeneration actions (20,000 ha per year).	2147,2	387,0	232,0
Avoided degradation (conditional part).	B1: Compensation for defences (30,000 ha per year); B2: Energy efficiency through the distribution of improved kilns (3000 kilns per year); B3: Better fire risk management including: Opening and maintenance of fire protection trenches (53 km per year); development of 5 water points per year; monitoring during periods of high sensitivity (145 lookouts per year);	1440,4	247,8	354,4

	Follow-up and diagnosis (220 observations per year).			
Strengthening the resilience of socio-ecosystems in vulnerable areas (conditional part).	D1: Establishment of maritime and continental dunes (800 ha per year).	4,2	0,8	174,4
Total		17624,4	2554,1	2850,3

8.3.2.4. Integrated actions: training and research

8.3.2.4.1. The main orientations in terms of research and training, the indicators (number of researchers, staff trained, budget mobilised) and their shortcomings

- **Green Earth Program**

Institutions: IAV Hassan II, ENA Meknes, INRA, ENFI

The EU-funded programme is part of the national agricultural research and training system. It aims to consolidate the ecological transition creating decent jobs within the framework of agricultural and forestry development, at the level of 4 pilot regions: Beni Mellal-Khenifra, Oriental, Tangier-Tetouan-Al Hoceima and Drâa-Tafilalet.

- Breakdown of the objectives of the Terre Verte programme

Overall Objective	Consolidating the ecological transition creating decent jobs in the context of agricultural and forestry development, at the level of 4 pilot regions	
Sub-objectives	Strengthen the efficiency of the agricultural "training, research and advisory support" chain and its adaptation to the challenges of the ecological transition	contribute to the redesign of a research-development-training centre adapted to the ecological, technical and socio-economic challenges of the sustainable management of Morocco's forest ecosystems
Produce	Measures and tools put in place to adapt the training offer to the new needs of the agricultural sector Support GG	Capacities and arrangements for training and research Strengthened forest sector FDM support
Indicators	Number of exchange and training platforms set up by the consortium	Percentage of training schemes strengthened

⇨ Areas of intervention in agriculture: Production methods integrating "nature-based" practices

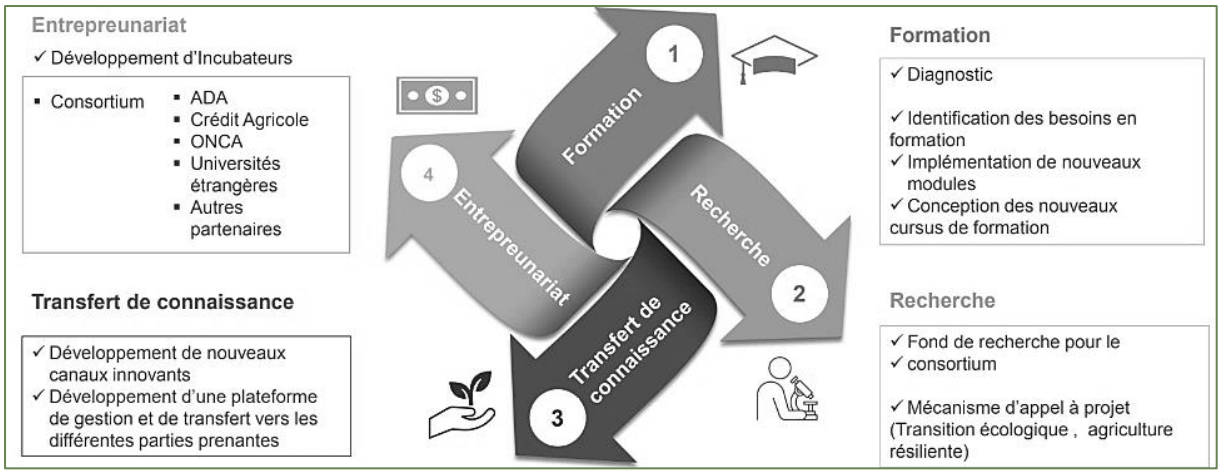
- Protection and regeneration of resources (soil, water and agrobiodiversity)
- Diversification of agricultural production (crop associations,
- agroforestry, agro-sylvo-pastoralism, rotations, etc.)
- Reduction of water, energy and decarbonized consumption
- Reduction in the use of synthetic inputs (fertilizers and cides)

⇨ Areas of intervention in forestry

- Protection of forest areas
- Combating land and forest cover degradation (effective reforestation)
- Sustainable and equitable use of forests and parks

These axes aim to cover several areas and strategic issues related to the major theme of ecological transition, such as agro-biodiversity, agroforestry, agro-sylvo pastoralism, organic farming, permaculture, mountain areas, oasis areas, watershed management, erosion control, MAP, agroecological practices of soil conservation and water saving and training related to the emergence of new professions related to Powers delegated to companies.

⇨ Action with 4 levers: Entrepreneurship-Training-Research-Knowledge Transfer



- **Programme for the Development of Agroecological Practices for Resilient Agricultural Systems in Semi-Arid Zones**

Institutions: INRA; partners: Ministerial directorates and public development institutions: ORMVA, ADA, DRAs, ONCA, DEER, ONSSA, Ch.A; Professionals: FIMABIO, AGENDA, AMAC, AMSSOL Industrialists or technology promoters: OCP, FOCP, BioCHAR Morocco, Lion Group (CHI), Scientific and academic partners: IAV HII, ENAM, ENFI, Univ. Rabat, Univ. Kenitra, UM6P, CNESTEN, ICARDA, CIMMYT, APNI, FAO, CREA LODI (ITA)

Dependent on harsh climatic conditions and limited natural resources, Morocco has included ecological agriculture in its agricultural development strategy for the decade 2020-2030. The high demand for food as a result of population growth has exposed agricultural land and water resources to intense land use, exacerbating the spiral of their degradation. This situation is becoming more and more critical as a result of climate change, which is causing a growing and accelerating imbalance, illustrated by the loss of biodiversity, water erosion, desertification, salinization, nitric pollution, eutrophication, etc. To reverse this trend, agroecology has positioned itself as an alternative agricultural model for the sustainability and resilience of Moroccan agricultural systems, whether for the solidarity and sustainable development of small-scale agriculture or for intensive agriculture called upon to be sustainable by consuming fewer inputs and providing ecological services to the ecosystems where it develops.

Program Objectives:

- Assess the quality of natural resources as a result of agricultural practices and biomass valorization;

- Improve arable crop production systems through a better conversion to conservation agriculture according to the specificities of agroecological zones; Promote Agroforestry in arid and semi-arid areas for improved productivity, resilience and sustainability of agricultural systems;
- Facilitate the widespread acceptance and adoption of conservation agriculture principles in the regions of Saïss, Zaër and Chaouia.

- **Conservation and Sustainable Rangeland Management Program in the Context of Climate, Socio-Economic and Institutional Change**

Institutions: INRA; Partners: Ministerial directorates and public development institutions: DRAs, Regional Water and Forestry Services; Professionals: Pastoral Cooperatives of the HPO Zone, Union of Pastoral Cooperatives, Federation of Pastoral Cooperatives, ANOC, ACEC; Scientific and academic partners: ENAM, IAV HII, Univ. Oujda, Univ. Meknes, Univ. Kenitra, Scientific Institute, Senckenberg Research Institute (Ger).

In grazing areas, pastoral livestock is the main economic activity of the population. Nearly 62 million ha of grazing land in Morocco is mainly in arid and semi-arid areas The flora in these areas is characterized by a diversity that is both rich and vulnerable. Indeed, the overexploitation of pastoral resources, the effects of climate change and recurrent droughts have accelerated the rate of degradation that these ecosystems have suffered for several decades. The consequences are illustrated by a very significant reduction in the area and pastoral production, a significant decrease in floristic diversity and consequently, an imbalance between the supply of pastoral fodder and the food needs of livestock. Research at INRA has led to the production of several cartographic tools that have illustrated the extent of this phenomenon and the rapid regressive dynamics of pastoral plant formations. The follow-up also concerned pastoral management actions; The positive impacts of several techniques have been quantified, namely resting, seed storage, shrub planting and rainwater harvesting techniques. In addition, research has been carried out on the characterization of pastoral species and the control of sexual reproduction of several species.

Program Objectives:

- Contribute to the development of strategies for adapting rangeland livestock to climate change with a view to improving its resilience;
- Contribute to the rehabilitation and preservation of biodiversity in arid pastoral areas;
- Improve the productivity of extensive goat farms and ensure the sustainability of forest rangelands through the use of new Smart Grazing technologies.

- **Digital Agriculture: Decision Support Tools for Forecasting**

Institutions: INRA; Partners: Ministerial directorates and public development institutions: DSS, ANDZOA, DRA, ONCA; Scientific and academic partners: IAV HII, Univ. Béni Mellal, Univ. Agadir, Univ. Oujda, UM6P.

Through this major project, INRA intends to capitalize on what has been achieved and open parallel projects that will bring it into line with international standards for digital agricultural data management. Indeed, we collaborated on the development of soil fertility maps and the ferti-advisory platform, the CGMS agricultural season monitoring tool and the integrated online model MOSAICC. The digital achievements also include digital cartographic databases such as those of the agricultural vocation of the land and the characterization of oasis areas, in addition to agronomic, agro-meteorological and agroeconomic models validated for the Moroccan

context and based on the techniques of spatial remote sensing coupled with machine *learning* for the management of agricultural space.

With an average temperature increase in Morocco of 1° since the 1960s, and a very likely scenario of an increase of 2.9° by 2050. This situation implies the need to develop decision-making tools for forecasting management. Also, nearly 7.8 million ha is the area covered by the *Fertimap* system for soil fertilization and crop fertilizer needs, and 2 million ha of area for digital *soil* mapping.

Program Objectives

- Set up a digital database of the current and future potential of soils in agricultural and natural areas
- Develop supporting tools to help guide plans and strategies for the management of climate-sensitive agricultural production systems
- Design and implement Big Data to contribute to decision-making and planning in agriculture and natural resource conservation
- Developing agro-economic tools for the sustainable management of production systems

8.3.3. The Sustainable Development Strategy

8.3.3.1. Definition of the environmental strategy: National Sustainable Development Strategy 2030

Central leader: Ministry of Energy Transition and Sustainable Development, and institutions under supervision

In order to achieve the intergenerational goal of sustainable development, it is imperative to secure a number of fundamentals to ensure a sustainable trajectory. The diagnosis revealed that sustainability ingredients are present in the majority of policies, but their implementation remains insufficient. It therefore seemed necessary to define a global strategy, which would set the course for all public policies. This direction is set by the following vision:

"Implement the foundations of a green and inclusive economy in Morocco by 2030"

The proposed vision is based on the integration of the 4 fundamental pillars of sustainable development; including economic, social, environmental and cultural issues. The sectors have their own strategies and the State's proactive policies support the country's economic development. The obstacles to competitiveness, identified during the diagnostic phase, could be removed, in particular by systematically seeking intersectoral convergence and by better integrating socio-environmental considerations. In addition, a real environmental economy is possible through the implementation of a circular economy, or green industrialization.

The social pillar should be strengthened, including health-related policies which, despite an improvement in terms of indicators, fall far short of the targets and are detrimental to human development. Access for all to free quality education is also a challenge to avoid exacerbating disparities. Finally, the fight against poverty, and the principle of solidarity (territorial solidarity in particular) should really be implemented. The rural populations of our mountain areas are the guarantors of water and forest reserves, and the remote populations in the oasis areas contribute to the fight against desertification. Yet, in both cases, they often live below the national average

for all socio-economic indicators. A more equitable redistribution, in particular by taking into account the notion of Payment for Ecosystem Services, is a possible alternative.

For its part, the environmental pillar proved to be the poor relation of development during the diagnosis. Environmental actions are essentially curative and respond to emergencies, but the environment is not yet considered a source of sustainable growth. This strategy aims to strengthen the consideration of environmental damage in public policies in order to decouple economic growth from pressure on resources, but also to create sustainable green jobs in environment-related professions.

Finally, taking into account the cultural pillar makes it possible to define a strategy based on the specificities of Morocco. Thus, with a focus dedicated to specific sensitive areas (Oasis, Coast, Mountain Areas), the integration of crafts as a component of the green economy and the promotion and enhancement of culture, the strategy has ensured that this pillar is operationalized.

To give substance to this vision, 7 major issues have been identified. Each issue is then broken down into strategic axes which are in fact major areas of action, with objectives to be achieved and measures and actions to be deployed.

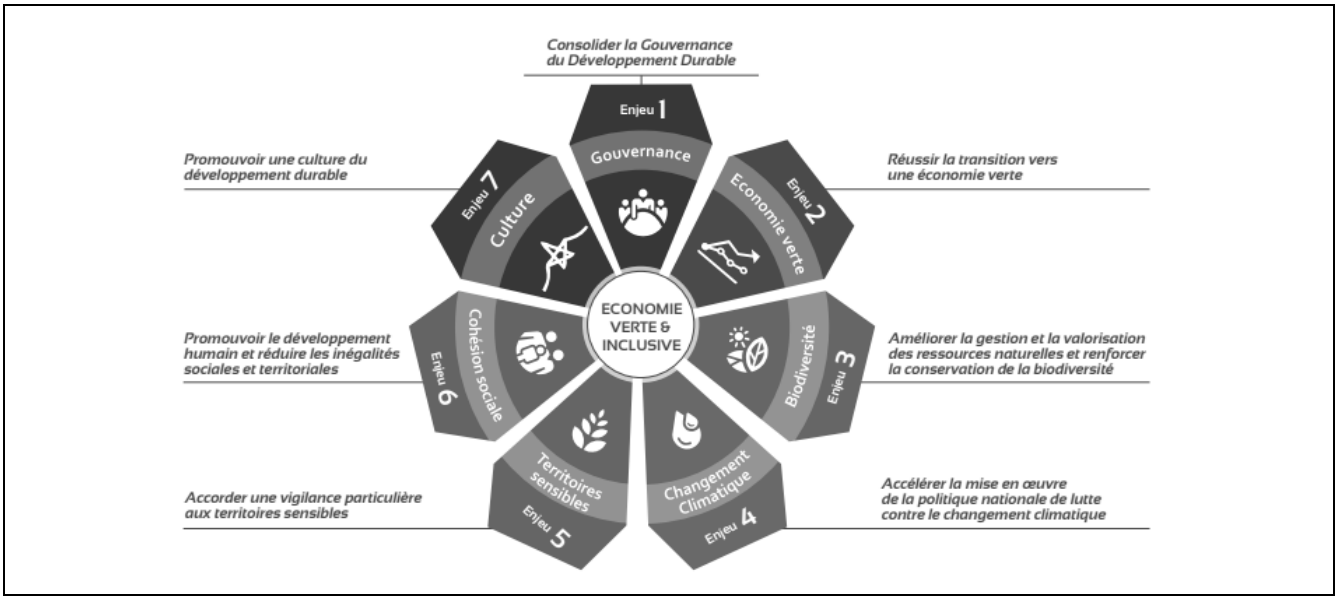


Figure 35: Schematic summary of the axes of Morocco's NSSD 2030

(*Source*: Official document of the NSSD strategy, Secretary of State for the Environment)

8.3.3.2. Key climate change adaptation measures adopted

8.3.3.2.1. Challenge 1: Strengthening the governance of sustainable development

Governance is a management method that involves consultation and should facilitate decision-making. The governance of sustainable development is made difficult by the fact that, in order to ensure the common management of natural resources, regulatory mechanisms must be put in place to support decision-making at

different levels. It must provide a framework for relations between the levels concerned and establish the legal and economic instruments for the effective implementation of a sustainable development policy.

A diagnosis had made it possible to identify the shortcomings and lack of coordination, which may be of an institutional, regulatory or financial nature. The inclusive vision of the green economy, as a vector of sustainable development, entails the need to break with the complexity and multiplication of projects and behaviours that harm the economy of resources or equity, as well as with financing mechanisms aimed at social categories that do not always have the means to do so. To ensure the implementation of good governance, 4 Strategic Axes have been identified:

- Strategic axis 1: Make the exemplary role of the State a lever for the implementation of sustainable development;
- Strategic axis 2: Strengthening the institutional framework for sustainable development and the role of stakeholders;
- Strategic axis 3: Strengthening the legal framework and control mechanisms
- Strategic axis 4: Strengthening economic and financial instruments and implementing an environmental tax policy

8.3.3.2.2. Issue 2: Making the transition to a green economy a success

Recently, the concept of "green economy" has become a central topic in political discourse. The growing interest in the green economy is accompanied by the idea that an economic alternative is possible, where material wealth does not necessarily lead to environmental risks, resource shortages and social disparities. There is a growing body of evidence to suggest that the transition to a green economy is economically and socially justified.

Several simultaneous crises, such as those related to climate, biodiversity, energy, food, water, as well as the global financial crisis, require urgent action. It highlights structural weaknesses and persistent risks, including continued reliance on fossil fuels and expected higher energy prices.

Medium/long-term balance and security require, according to the text, a change in investments, prioritising sectors such as energy efficiency, public transport, sustainable agriculture, ecosystem protection and soil preservation. The strategy recognizes that the green economy is not a substitute for the concept of sustainable development, but that there is a growing recognition that achieving sustainable development depends largely on an appropriate economic approach. The need for a "greening" of the economy is highlighted as essential to achieve the Sustainable Development Goals and ensure a decoupling between economic growth and pressure on natural resources.

To ensure the implementation of good governance, 11 Strategic Axes have been identified:

- Strategic axis 5: Reconciling the modernisation of the agricultural sector with the requirements of sustainable development
- Strategic axis 6: Ensuring the conservation and rational management of fisheries resources
- Strategic axis 7: Enhancing the value of forests for sustainable management
- Strategic axis 8: Placing Industrial Acceleration in a green economy trajectory
- Strategic axis 9: Accelerating the implementation of the energy transition

- Strategic Axis 10: Have a sustainable mining sector
- Strategic axis 11: Promoting sustainable crafts
- Strategic axis 12: Promoting sustainable mobility
- Strategic axis 13: Reconciling tourism development and environmental protection
- Strategic axis 14: Promoting integrated waste management to implement a circular economy
- Strategic axis 15: Aligning urban planning with the principles of sustainable development

8.3.3.2.3. Challenge 3: Improve the management and development of natural resources and strengthen biodiversity conservation

As a country of bioclimatic and ecological transition, Morocco is facing a rapid fragility of its resources, including soils vulnerable to erosion, rapid deforestation, the threat of desertification in steppe areas, coastal erosion, the scarcity of marine resources and the constant loss of precious biotopes. Natural disasters threaten the territory, while long-term planning and contingency plans are often neglected.

These challenges have implications for the future availability of resources, as well as for the hygiene and sanitation conditions of the environment. The prospect of environmental change seems unsustainable, with the depletion of resources and the degradation of the living environment, leading to high costs for the community with no guarantee of curative effects.

Challenge 3 requires a well-thought-out approach that can limit resource degradation while generating opportunities for economic and social development. Notable efforts have already been undertaken, such as the overhaul of the legal framework with a law on protected areas in 2010 and the development of the national wetland conservation strategy. These actions must be strengthened to preserve fragile ecosystems, enhance them, make them known and promote a rational use that respects their balance.

- Strategic axis 16: Securing water supply to user sectors and strengthening integrated water resources management
- Strategic axis 17: Improving knowledge of soil pressures
- Strategic axis 18: Closing the education gap: Protecting biodiversity and strengthening conservation policies

8.3.3.2.4. Issue 4: Accelerate the implementation of the national policy to combat climate change

Morocco has begun a transition to a new development model focused on green growth. This transition includes major initiatives such as energy policy, energy efficiency, water saving, sustainable waste management and the National Human Development Initiative.

Although Morocco is considered a low emitter of greenhouse gases, its geographical position makes it vulnerable to climate change, such as desertification, floods and water scarcity. Agriculture's dependence on rainfall exacerbates this vulnerability. The growing needs of people and industries, as well as immigration from sub-Saharan regions affected by climate change, are increasing these vulnerabilities, ultimately threatening food security.

To address these challenges, Morocco is committed to implementing adaptation and mitigation actions, supported by strong political will, in particular through the National Charter for the Environment and Sustainable Development. This policy is part of the international framework to combat climate change, with the agreement of the COP 21 in Paris in 2015. Morocco's National Climate Change Policy is the operational framework for the development of a medium- and long-term strategy for climate-resilient green growth, coordinating different measures and initiatives.

- Strategic axis 19: Improving climate governance
- Strategic axis 20: Involving territories in the fight against global warming
- Strategic axis 21: Seizing the opportunities of climate finance: Including territories in an approach to the fight against global warming

8.3.3.2.5. Issue 5: Paying particular attention to sensitive areas

Morocco has a significant territorial diversity, which presents it with various challenges. However, these challenges converge on the need to preserve resources, improve the attractiveness of each territory and seek competitiveness by exploiting comparative advantages. The National Strategy for Sustainable Development recommends a strengthening of actions in favor of the most sensitive territories, by identifying three types of territories with distinct characteristics that require coordination of efforts to ensure their sustainable development.

The coastline, which is home to 54 per cent of the population, 80 per cent of industries and 50 per cent of tourism infrastructure, is subject to multiple pressures that threaten its sustainability, such as urbanisation and pollution.

The oases and desert areas, covering more than 40% of the territory, are poor regions, poorly equipped with infrastructure and with great fragility. The oases and the argan grove play a crucial role as bulwarks against the advance of desertification, making them a priority to maintain the ecological balance in the rest of the country.

Mountain areas, rich in water resources, fauna and flora, represent contrasting territories. Despite this, the population living there faces great poverty, with social indicators well below the national average.

- Strategic axis 22: Improving sustainable coastal management
- Strategic axis 23: Preserving and enhancing oasis and desert areas
- Strategic axis 24: Strengthening management policies for mountain areas

8.3.3.2.6. Issue 6: Promoting human development and reducing social and territorial inequalities

Morocco has made significant progress in improving its social situation, exceeding some of the Millennium Development Goals (MDGs). Notable achievements include reducing the poverty rate from 15% in 2001 to 6% in 2011 and unemployment from 14% in 1999 to 9% in 2012. In addition, the youth literacy rate increased from

58% in 1994 to 85% in 2012. Despite these successes, gaps remain, particularly in education, gender equality and maternal health.

However, this progress masks significant disparities between regions, rural and urban areas, and gender. Although relative poverty fell by at least 50% in all regions between 1985 and 2011, the most disadvantaged regions show more modest reductions, creating large gaps.

Morocco is working to address these inequalities through initiatives such as the National Initiative for Human Development (INDH), which has carried out more than 22,000 projects in six years, benefiting 5 million people. Sectoral plans, such as the Green Morocco Plan, aim to increase agricultural production and improve the incomes of vulnerable rural people.

Despite progress in education, challenges remain, including the exclusion of nearly 900,000 children from education provision, persistent regional and gender disparities, and issues related to equity and quality of education. Improving student retention rates and reducing repetition are goals to strengthen equity and quality of education.

Thus, the sixth challenge of the National Sustainable Development Strategy aims to promote human development and reduce social and territorial inequalities. Three strategic axes have been identified:

- Strategic axis 25: Capitalizing on the achievements of the NHRI to fight poverty
- Strategic axis 26: Strengthening the health system and health surveillance
- Strategic axis 27: Closing the education gap

8.3.3.2.7. Issue 7: Promote a culture of sustainable development

Achieving the objectives of the national sustainable development strategy requires the implementation of accompanying measures. Scientific research plays a crucial role in anticipating problems, clarifying issues and proposing solutions, thus providing essential elements for social and political decisions. The transition to a green economy has an impact on existing sectors, requiring the adaptation of training to recruit individuals who are aware of environmental issues.

Green jobs are not only presented as a response to the imperatives of environmental protection, but also as an opportunity for social inclusion in Morocco, creating jobs for qualified young people and offering prospects to people in precarious situations. Although the strategy focuses on priority actions, sustainable development is an intergenerational process, with real transformation through the education of children and youth in eco-citizen values, thus forming a sustainable culture for the future.

- Strategic axis 28: Strengthening eco-citizenship, through education, awareness-raising and communication programmes
- Strategic axis 29: Make innovation and research and development the lever of transition for the realization of sustainable development
- Strategic axis 30: Improving training for green professions
- Strategic axis 31: Promoting culture as a lever for change towards a sustainable society

8.3.3.3. The main measures adopted to preserve natural resources (land, water and biodiversity)

8.3.3.3.1. Environmental and Social Risk Mitigation Schemes

Key measures to mitigate environmental risks include systematically (i) feasibility studies that integrate environmental design, including in major projects such as liquid tributary treatment plants, and waste management; (ii) strategic environmental assessments, including for the establishment and renovation of wholesale markets; (iii) environmental and social impact assessments (ESIAs) in accordance with the procedure provided for in various laws, in particular Law 12-03 for the creation of wholesale markets; and (iv) the inclusion in the specifications of public calls for tenders for major projects, such as the creation of wholesale contracts, of a section on compliance with environmental and safety clauses on construction sites and compliance with the conclusions and recommendations of the ESIAs and the related ESMPs.

8.3.3.3.2. National legal framework for environmental management

Morocco has an important legal framework regarding environmental management and, in particular, the management of environmental impacts. This concerns the majority of aspects related to environmental protection, the fight against pollution and the improvement of the living environment, including preventive instruments (Environmental Impact Assessments, EIAs) and incentives (financial aid and tax incentives), as well as coercive measures against natural and legal persons committing offences of pollution or environmental degradation. Some texts are general or horizontal in nature and others are specific to sectoral activities. With regard to environmental impact assessments, the most important piece of legislation is Law No. 12-03 of 12 May 2003 (promulgated by Dahir No. 1-030 of 10 Rabii I 1424. The aim of this legislation is to minimise the negative impact of projects and improve ecological sustainability. This law establishes the list of projects subject to the regulation, the procedure for carrying out and the consistency of the impact assessments. The law also establishes a National Committee for Environmental Impact Assessments, chaired by the Secretary of State for Sustainable Development, and a Regional Committee for Environmental Impact Assessments, chaired by the Wali, at the regional level.

The formalities for the establishment of these two committees and their powers shall be laid down by regulation. The role of these committees is to decide, on the basis of the results of the impact study, on the environmental acceptability that conditions the implementation of the projects subject to the project. This law is supplemented and reinforced by two implementing decrees, namely: (i) Decree No. 2-04563 relating to the powers and functioning of the national and regional committees for environmental impact assessments, and (ii) Decree No. 2-04-564 setting out the procedures for the organization and conduct of the public inquiry relating to projects subject to environmental impact assessment. Among other things, the law gives a fairly comprehensive definition of the concept of "environmental impact assessment" by stipulating that it is any "preliminary study to assess the direct or indirect effects that may affect the environment in the short, medium and long term following the implementation of economic and development projects and the establishment of basic infrastructure and to determine measures to remove, mitigate or compensate for the negative impacts and enhance the positive effects of the project on the environment" (Department of the Environment).

8.3.4. The Water Strategy

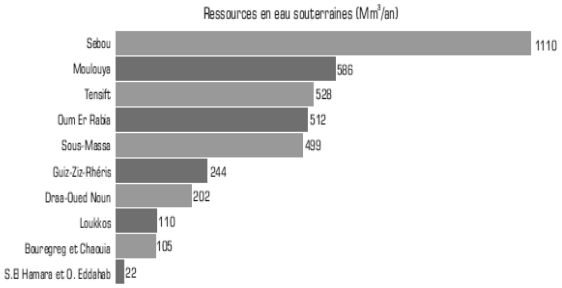
8.3.4.1. Overview of water resources in Morocco

Water resources by the numbers

- The average annual rainfall inputs throughout the country are estimated annually at around 140 billion m3;
- Average natural water resources are estimated at 22 billion m3/year, equivalent to 3,606 m3/inhabitant/year in 2023;
- Annual evapotranspiration is estimated at 118 billion m3/year;
- Natural water resources are estimated at 22 billion m3/year, of which 18 billion m3/year is surface water and 4 billion m3/year is groundwater.

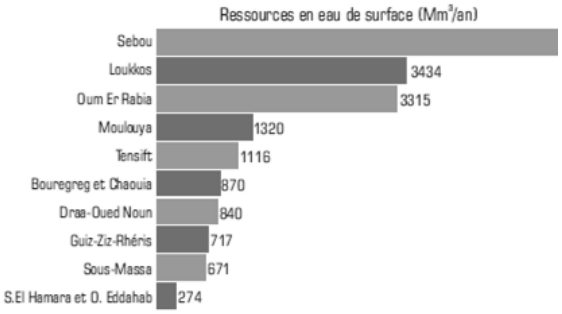
Underground Resources

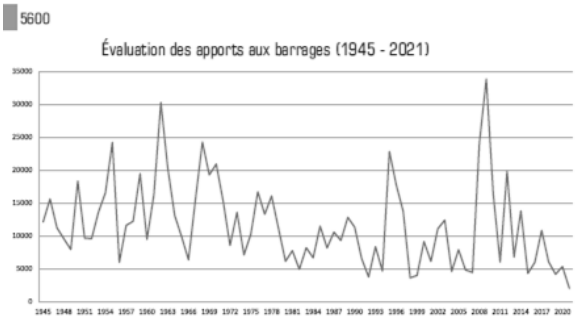
130 aquifers, of which 32 are deep and 98 are shallow. The potential of groundwater resources is currently estimated at 4 billion m3/year.



Superficial Resources

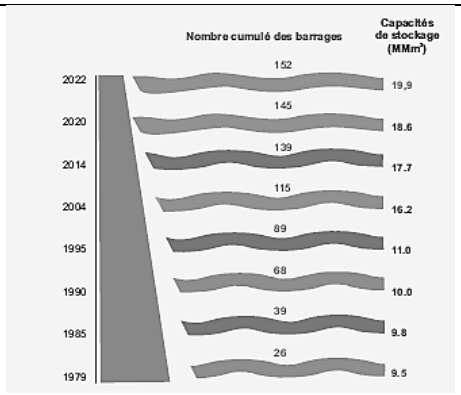
Surface water resources are characterized by a high degree of irregularity in space and time. They are currently estimated at 18 billion m3/year.

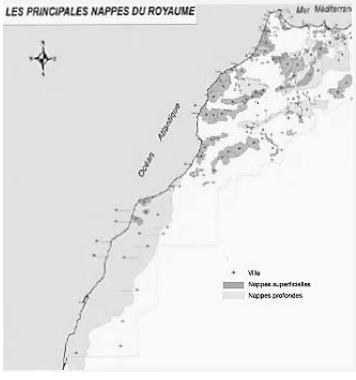




Surface water

Morocco currently has a portfolio of 152 large dams with a storage capacity of 19.9 billion m3. In order to achieve a balance between basins, 16 water transfer structures with a total length of nearly 785 km and a flow rate of 16 have been built.





Increasing reliance on non-conventional water resources

Seawater desalination Morocco currently has 12 existing plants with a capacity of nearly 118,700 m3/d. Seven stations are under construction or launch with a capacity of 396,200 m3/d.	**Wastewater reuse** The country currently has 41 projects for the reuse of treated wastewater, allowing for the reuse of a volume of nearly 32 Mm3/year.
Breakthroughs in the drinking water sector Access to drinking water is widespread with a production capacity of 1324 Mm3/year. The rate of access to drinking water in rural areas is currently more than 98.4%.	**Decentralised water resources management** 10 Water Basin Agencies and 6 delegations have been set up with the creation of Water Basin Councils, responsible for examining and giving advice on issues relating to water planning and management.
Water Information System - 2000: BADRE 21 system (Water Resources Database), decentralised to the 10 ABHs - In progress: National Water Information System) is now registered as a component of the PNE and Integrated and Unified Management Information System and the management control system.	

8.3.4.2. Definition of the Water Strategy: National Programme for Supply, Drinking Water and Irrigation (PNAEPI) 2020-2027

- **Context**

The annual and seasonal changes projected by future climate change scenarios (CMIP3, CMIP5 and CMIP6) pose significant challenges, particularly due to increased evapotranspiration and decreased precipitation. Changes in hydrographs and precipitation patterns in different regions will affect the storage capacity and operating patterns of dams compared to their current conditions. The ability of water systems to meet the demand for drinking, agricultural and environmental water as well as flood protection will be significantly affected. Also, the need to release flood protection will increase the vulnerability of systems to drought. This raises the question of the storage capacity of dams, which is a major obstacle to meeting projected future demand. Thus, the need and importance of dams and their interconnection to secure water supply and protection of people and property from flooding will increase, with an expected increase in the impact of dams on downstream flows in the future, especially during the drier months of the year.

In addition to the reduction in precipitation confirmed by current facts and climate models, several studies have focused on interannual variability and the occurrence of extreme events (Zemzami and El Kadiri, 2015). In addition, when rainfall tends to be more and more intense, this generates significant runoff, low groundwater recharge and a limitation of the renewal of its reserves.

From this overview of our current context, an awareness of the fragility of each country's water system emerges and, therefore, the strategy to be implemented to lock in the related causes of risks.

- **Strategic Directions**

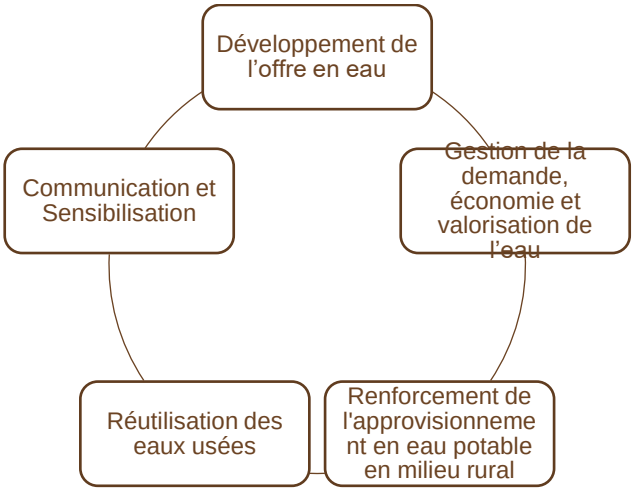
The strategic orientations of the water sector, which have been formulated at the level of the PNEAPI strategy 2020-2027, are as follows:

- Continuation and strengthening of the policy of supply development through the construction of dams and the transfer of water between the various hydraulic systems. The promotion of non-conventional waters, including seawater desalination and the reuse of treated wastewater, according to an integrated approach;
- Water demand management, which should lead to water savings and a consequent enhancement of the water resources mobilized in terms of irrigation, drinking and industrial water and other uses and uses;
- Preservation and protection of water resources and ecosystems;
- Management of extreme weather events (Floods and Droughts).

- **Statement of the PNAEPI Strategy 2020-2027**

The National Programme for Drinking Water Supply and Irrigation (PNAEPI) 2020-2027 aims to accelerate investments in the water sector to strengthen drinking water supply and irrigation and strengthen our country's resilience to climate hazards and disruptions. The four main objectives of the programme are: (i) To support water demands and socio-economic development; ii) Addressing Climate Change; (iii) Ensuring water security and (iv) Strengthening and diversifying water supplies.

The strategy operates through 5 main axes which relate to the development of water supply, demand management, water saving and valorization, the strengthening of the supply of drinking water in rural areas, the reuse of wastewater, and finally communication and awareness.



⇨ Development of the water supply

- continued construction and/or elevation of large dams (21 dams)
- the construction of medium and small dams and hill lakes for local development
- prospecting and improving groundwater knowledge
- the development of seawater desalination projects (1.5 billion m3 in 2030)

⇨ Demand management, water conservation and valorization

- Saving drinking, industrial and tourist water through:

- improving the efficiency of drinking water distribution facilities (78% by 2027)
- Increasing the autonomy of drinking water reserves

- Saving irrigation water by:

- Collective and individual conversion to localised irrigation
- Modernization and rehabilitation of multi-purpose water supply systems

⇨ Strengthening the supply of drinking water in rural areas

- The continuation of the programmes already undertaken for the counters and douars concerned;
- The establishment of a programme for additional douars not provided for in the programmes already undertaken.

⇨ Wastewater reuse

- the reuse of treated wastewater for watering golf courses and green spaces: 100 Mm3/Year in 2027

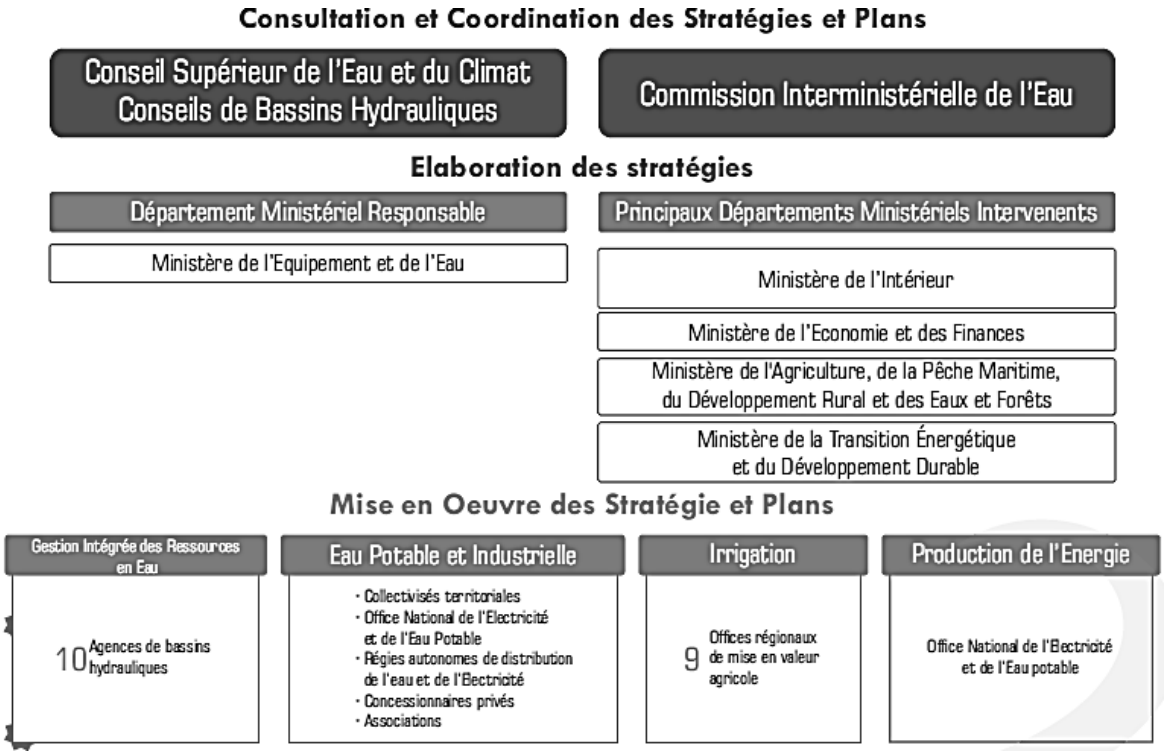
⇨ Communication & Outreach

- Corporate communication
- Communication for the general public for behaviour change

The overall cost of the strategy amounts, after revision, to 143 billion dirhams for the period 2020-2027. The cost of the seawater desalination and SBOT interconnection projects, which will be carried out in a Public-Private Partnership (PPP) basis, are not taken into account in the overall cost of the PNAEPI after adjustments. The State's contribution to such PPP projects will be decided on a case-by-case basis.

- **Institutional organization**

The water sector is by nature a cross-cutting and sensitive sector. Its governance at the national level requires an organization that combines primary responsibility, collective responsibility, concerted participatory management and steering via commissions and higher councils. The following figure illustrates the institutional organization of the water sector organized into 3 levels: consultation and coordination at the supra and interministerial level, strategic programming at the ministerial level and then implementation, particularly at the level of the water basin agencies, the National Office of Electricity and Drinking Water, the local authorities, the water distribution boards, and Regional Agricultural Development Boards.



8.3.4.3. The main measures adopted to adapt to climate change and preserve natural resources

- **Ecologically sensitive aspects of the strategy**

Several elements of the PNAEPI provide for security and development axes that are sensitive to the ecological and climatic context. The reuse of wastewater, communication and awareness-raising, demand management, saving and valorization of water are in particular 3 axes that consist not only of meeting social needs in terms of water but also of considering sustainability in the mode of use. Other measures, such as the continued construction of dams and the development of hill lakes, are part of the adaptation to climate change.

- **Regulatory and institutional aspects**

A new Water Law 36-15 drafted within the framework of a broad national and regional consultation provides for the creation and consolidation of the following elements:

- The creation of Water Basin Councils
- Establishment of rules relating to participatory management contracts
- Development of local water management plans
- Setting up water information systems
- Integrating climate change into the water planning process
- The establishment of a legal framework for seawater desalination and the water scarcity management plan in the event of drought
- Establishment of a legal framework for flood prevention and protection
- The obligation to maintain a minimum flow rate for the environment

- The obligation to have liquid sanitation master plans
- The integration of wastewater into the public hydraulic domain
- Strengthening the legal framework for the reuse of treated wastewater
- Equal access for citizens to water and a healthy environment

8.3.5. The fisheries strategy

The fisheries sector is a key social, economic and food sector. In particular, it contributes to the country's food security, the employment of some of the coastal populations in fishing villages and trade with partner countries. The sector has contributed 2.3% to GDP over the past 10 years. It has an export turnover of 13.2 billion MAD, representing 10% of total exports and 50% of agri-food exports. In terms of employment, it provides nearly 170,000 direct jobs and 490,000 indirect jobs, making a living from this sector.

By sector, pelagics make up 81% of the volume caught, but only 23% of the value. The most valued sectors are cephalopods, crustaceans, and in the background white fish, which together account for 19% of the volume but 77% of the value. According to official statistics, coastal and artisanal fishing makes up the majority of the sector with 77% of the volume and 52% of the value, consisting mainly of pelagics. This is followed by deep-sea fishing, with 11% of the volume and 42% of the value, mainly cephalopods, while the remainder is chartering (pelagic).

The Moroccan coastline comprises, according to the extensive definition, about 66,000 km² of territorial waters and 1.1 mkm² of exclusive maritime economic zone. The continental part of the coastline includes 187 municipalities, representing an area equivalent to 1/7 of the territory. The operational fishing fleet consists of more than 14 thousand boats, 1.8 thousand coastal vessels and 340 offshore vessels. They are spread over 22 fishing ports and 22 points set up for small-scale fishing in isolated areas along the Atlantic and Mediterranean coasts.

The fishing industry sector in Morocco comprises 6 main branches of activity: freezing, canning, fresh packaging, semi-canning, manufacture of fishmeal and fish oil and seaweed processing.

8.3.5.1. Definition of the fisheries strategy: HALIEUTIS 2007-2020

The Halieutis Strategy 2007-2020 announced promising social and economic ambitions. In particular, it expected an increase in the sector's PV from MAD 8.3 billion to MAD 21.9 billion over the period, while the actual realization, particularly in 2019, amounted to nearly MAD 17.3 billion. It also counted on a significant increase in direct employment of +80% and indirect employment of 21500 jobs, an increase in exports of 160%, an increase in national consumption to 16 kg per capita per year and an application of fishing quotas for the preservation of the resource from 5% to 95%.

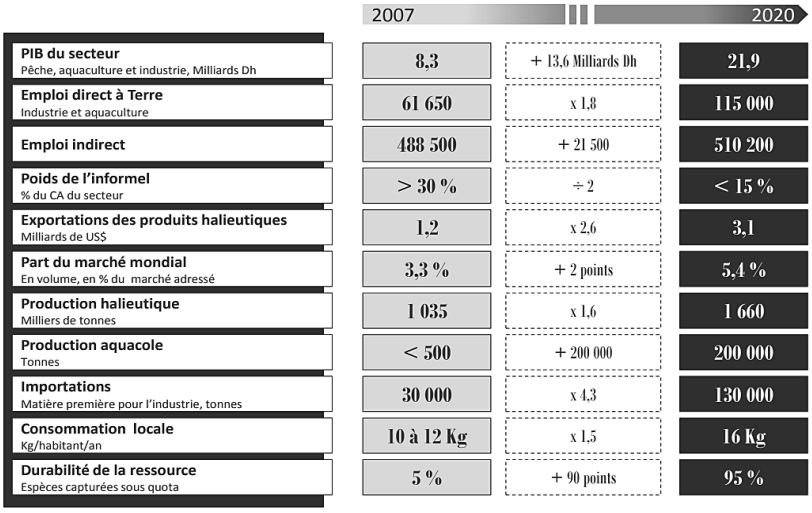


Figure 36: Objectives of Morocco's Halieutis Strategy 2007-2020

(*Source*: Official Strategy Document, Department of Marine Fisheries)

- **The ideas behind the strategy**

The 2020 halieutis strategy is based on structuring ideas, which consider the fishery resource as a sustainable natural heritage: all fisheries, of commercial interest, are managed on the basis of quotas. It also considers aquaculture to be a strong growth driver, with two aquaculture activities: fish farming and shellfish farming. Fishing ports are also considered as levers that are supposed to be structured and equipped to serve the sector, as dedicated port areas managed by a "Global Operator". Catches must be exploited on land: a new fishing port in the South and 3 competitiveness clusters in the North, Centre and South of the Kingdom. And finally, controlled flows throughout the value chain, promoting an effective control system at sea and on land.

- **Major axes and strategic challenges**

The strategy is organized around 3 major axes: sustainability, performance and competitiveness, supported by a fourth transversal axis relating to governance, control, organization and attractiveness of the sector. These axes are broken down into 16 strategic issues (translated into projects) as shown in the following table.

Table 44: Major axes and projects of Morocco's Halieutis strategy 2007-2020

Durability	**Performance**	**Competitiveness**
A1. Strengthening and sharing scientific knowledge **A2.** Quota-based fisheries management **A3.** Adapting and modernising fishing effort **A4.** Making aquaculture a major driver of growth	**B1.** Develop disembarkation infrastructure and equipment **B2.** Dedicating port areas to fishing and ensuring their effective management **B3.** Structuring and revitalising the internal market around wholesale and retail markets **B4.** Strengthening the attractiveness of tidal halls and CAPIs	**C1.** Facilitating access to raw materials for manufacturers **C2.** Supporting the orientation of manufacturers in the most promising markets **C3.** Create 3 competitiveness clusters in the North, Centre and South of the Kingdom
Cross-cutting actions		

D1. Clarifying and completing the legal framework
D2. Ensure effective control and traceability throughout the value chain
D3. Strengthening skills and improving the attractiveness of professions
D4. Organising professional representation and encouraging an inter-professional organisation
D5. Putting in place strong public governance to modernise the sector

8.3.5.2. The main measures adopted to preserve natural resources

The Halieutis strategy announces that the 16 projects have been designed in such a way as to meet the principles of Sustainable Development (Ecological-Social-Economic). The first component, which is ecological, envisages preserving the biodiversity of the marine environment, combating overfishing, ensuring the recovery of stocks of endangered species and promoting sustainable fishing practices. The second component, which relates to social acceptability, envisages improving the working and living conditions of fishermen, valuing the work of women, and improving the nutritional contribution of the resource (protein) for Moroccan consumers. The final component, which deals with the economy, is to maximize the value of seafood products and job creation, the improvement of the competitiveness of products in historical markets, and the penetration of new markets.

The 3 projects with a high environmental impact are the projects called A1. Strengthening and Sharing Scientific Knowledge, A2. Manage fisheries on the basis of quotas and A3 Adapt and modernise fishing effort. These projects are each divided into 3 actions which deal in particular with research, information, cooperation, quotas, fisheries differentiation, and the fishing fleet.

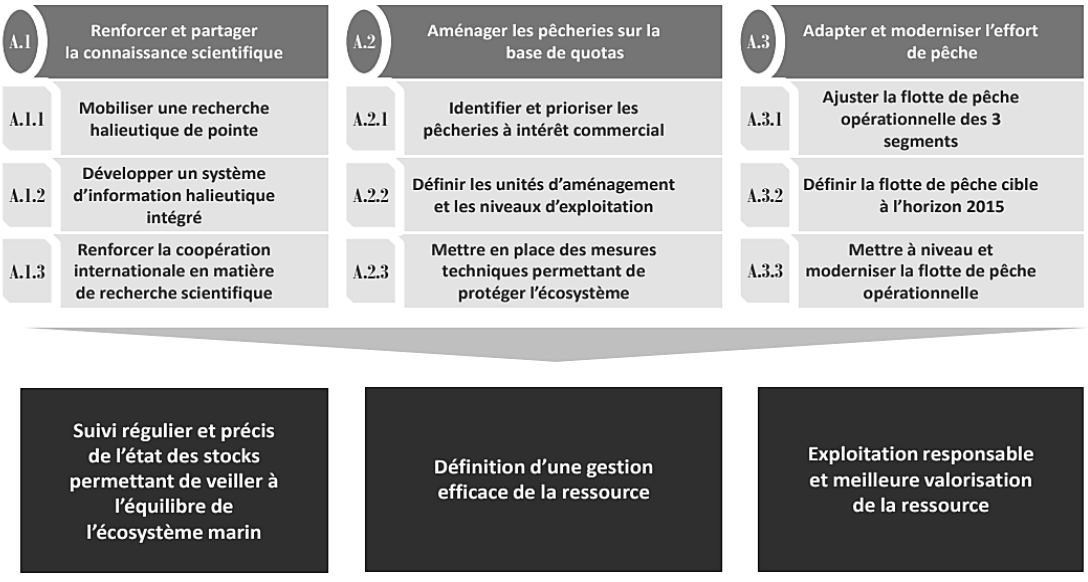


Figure 37: Projects with a high environmental impact, Morocco's Halieutis 2007-2020

(*Source*: Official Strategy Document, Department of Marine Fisheries)

- **Institutional organization**

The fisheries sector is under the supervision of the Department of Maritime Fisheries, within the Ministry of Agriculture, Maritime Fisheries, Water and Forestry and Rural Development. The Department is supported by several public institutions under supervision such as the National Fisheries Office and the National Institute for Fisheries Research (INRH).

The Halieutis strategy has provided for institutional development that has led to the creation of the National Fisheries Committee (Governance), the Fund for the Adjustment and Modernization of Fishing Effort (Financing), the Agency for the Development of Aquaculture (Promotion and Development), the Centre for the Valorization of Fishery Products (Technology Watch) and the Observatory of Employment in the Fisheries Sector (Training).

8.3.5.3. Research and training activities

- **Research**

The main driver of research in the field of fisheries is the INRH, whose main scientific achievements have focused in particular on:

- Monitoring of environmental and health conditions of the marine environment, animal health status, the state of ecosystems, the state of fisheries resources and fisheries farming systems;
- Understanding the functioning of the marine ecosystem as well as the fluctuations of exploitable resources in the face of variability in the conditions of the marine environment;
- R&D projects in aquaculture and the development of seafood products to support the diversification of Morocco's supply of aquaculture products as well as fishery products;
- Cross-cutting pilot studies, the results of which are of direct use either to the profession or to the fisheries administration, and which aim to answer immediate questions in the field of sustainable development of fisheries and aquaculture.

A reading of the results of the research carried out by INRA during the period covered by the Halieutis Plan reveals a large number of scientific actions that are quite diverse in terms of oceanography, sea fishing and the development of seafood products. However, to limit ourselves to aspects related to the preservation of ecology, we summarize below some of the oceanography-related actions carried out in 2020 that are ecological, by way of example.

- Oceanographic monitoring of the Atlantic and Mediterranean coasts in 3 campaigns carried out in the North and South Atlantic and in the Mediterranean in different seasons;
- Diagnosis of the state of fisheries in the Larache region to study the impact of environmental parameters on fluctuations in biomass;
- Monitoring the state of marine ecosystems in Mediterranean and Atlantic waters by operational numerical modelling;

- The development, within the framework of the Moroccan Fisheries Observatory, of instruments for the daily recording of information relating to oceanographic and meteorological parameters on the surface;
- Assessment of the impact of sand dredging (case of the Larache area);

In terms of health, the Ministry and the INRH have developed aquaculture engineering, animal health and health surveillance programmes (particularly in the production areas of shellfish, bivalve molluscs, shellfish and wild fish).

Coastal and coastal zone monitoring programmes in support of national aquaculture plans focused on oceanographic monitoring (hydrobiology, currentology, sedimentology, bathymetry, hydrology, numerical simulation of biogeochemical components) in 2020, which mainly concerned the bay of Dakhla, the area of Sidi Ifni, the bay of M'diq and Oualidia, Tarfaya, Moulay Bousselham, Larache, and Al Hoceima Bay.

Concerning the fisheries aspect, and for the monitoring of by-catch and discards at sea in the Mediterranean, a programme has been set up and involves several partners including the INRH, ACCOBAMS, BLI (BirdLife International), the SPA/RAC (Regional Activity Centre for Specially Protected Areas - UNEP/MAP-RAC/SPA), the GREPOM (Research Group for the Protection of Birds of Morocco – BirdLife Morocco).

Other study projects have focused on the interactions between seine fishing and bottlenose dolphins in the western Mediterranean; MAVA Project Depredation by bottlenose dolphins in the pelagic fishery in the Mediterranean; \u2012 MED By Catch project, monitoring discards and incidental catches of vulnerable species in the Moroccan Mediterranean; Project: Study of the reproductive cycle of natural populations of sea cucumber (Holothuria arguinensis) at Skhirat and Souiria Kdima.

- **Formation**

Since the implementation of the Halieutis Plan in 2009 and the entry into force of the STCW-F international convention, the main actions carried out during 2020 have concerned the training leading to a diploma in human resources for the management of the fishing fleet, the adaptation of the regulatory tool governing the prerogatives of patents, the implementation of basic safety training programmes, continuing education, functional literacy and extension, and the implementation of specific training actions, at the request of the profession, such as the training of future fish farmers, fishmongers or refiners.

As for initial training in the field of sea fishing, it is provided by the Higher Institute of Maritime Fisheries, the Hassan II Agronomic and Veterinary Institute, 5 Institutes of Maritime Fisheries Technology (ITPM) in Al Hoceima, Larache, Safi, Tan Tan and Laayoune, and 8 Maritime Professional Qualification Centers (CQPM) in Nador, Tangier, Casablanca, Essaouira, Agadir, Sidi Ifni, Boujdour and Dakhla. According to a summary reading of the training curricula, they integrate the consideration of sustainable development, but in a rather classic way, it seems.

8.4. Analysis of the Strategies Adopted

8.4.1. The Agricultural Strategy

The discussion of the current Generation Green 2020-2030 agricultural strategy would require a little contextual reminder in relation to the previous strategy entitled Green Morocco Plan (PMV) 2007-2020. The PMV is an impactful strategy that has been based on several good ideas. To briefly mention only the salient elements, the PMV has proceeded by means of financial incentives, not in the form of compensatory payments on agricultural costs or products (this was abolished with the structural adjustment plans), but in the form of investment incentives, which are supposed to modernize and restructure the agricultural fabric in a sustainable and capitalizable manner. These incentives have been aimed in particular at the conversion to high value-added crops, agricultural intensification (irrigation, equipment, selected seeds, fertilization, machinery, etc.), the promotion of niche products, and the development of agro-industrial packaging and processing units.

The postulates of the PMV stem from a philosophy that advocates grouping and contractualization. In terms of consolidation: the strategy provided for remedying the structural smallness of agricultural holdings through aggregation (commercial grouping), the promotion of professional organisations such as cooperatives and the creation of inter-branch organisations (professional and inter-professional groupings), in the absence of land aggregation, which seemed premature at the time, and which was later resolved by the GG at the strategic level through the establishment of mechanisms facilitating generational land transfer. In terms of contractualization: aggregation has been coupled with contractualization, so that large and small farmers, professional organizations and agro-industrial companies collaborate according to the terms of an aggregation contract between aggregators (large pivotal structures) and aggregates on the basis of win-win relationships, opening access to specific incentives in this context. Contractualization in agriculture has also been materialized by the development of program contracts between the State and the inter-professional organizations, mutually committing to the means to be implemented and the expected results by sector, particularly in terms of employment, production, commercial performance and exports.

The PMV has also focused on resource management, by deploying irrigation-related programs, particularly around the saving of irrigation water and the extension of irrigation. Finally, the PMV also relied on public-private partnership (PPP) as a tool for mobilizing finance, risk-sharing and conditional access used in the field of irrigation and in the exploitation of state land resulting from agrarian reform.

The PMV has made it possible to achieve a certain transformation of the sector, with regard to the agronomic and economic performance of the various sectors in terms of production, satisfaction of national demand and exports. However, several criticisms have been made as a result of an economic situation weighed down by successive years of drought. Some analysts blame the MVP for all the drought-related declines. They argue that the transformation of the agricultural fabric is artificial because it does not take into account the real potential and vocations of the Moroccan agricultural ecosystem, which is originally agropastoral. Morocco's agricultural land remains predominantly rainfed, as less than 20% of the UAA is irrigable and consumes more than 87% of the country's renewable water. It remains to be noted, however, that rainfed land has also benefited from certain actions (to a lesser extent, of course) such as access to selected seeds, subsidized agricultural insurance, the generalization of the practice of direct seeding, labeling and incentives linked to the organic sector.

Other analysts are more moderate in their thinking, saying that the PMV has been a good strategy (less eco-far-sighted in the long term, indeed) but which has coincided with a "disqualifying" climate crisis. Their arguments deal with the idea that this plan has exploited groundwater that is in any case surplus to domestic use by agricultural households, and that this water has no other use if it is kept in reserve. Also, the PMV has mobilized surface water that exceeds domestic need and that should have been released in any case to reduce evaporative losses and the risk of flooding in certain areas. About 60 per cent of water is lost through runoff and evaporation, which is why the Government of Morocco encourages and subsidizes micro-irrigation techniques.

The promotion of micro-irrigation was accompanied by technical advice on irrigation practices, crop selection, and strengthening linkages with agribusiness and export markets. The expected results were water savings of 30 to 50% (1 billion m3 per year). In response to the growing demand for water from agriculture and the depletion of groundwater, Morocco has introduced basin agreements, which are voluntary between the Government and stakeholders residing in a watershed footprint (ABH, user associations and farmers) and aim to regulate and improve the technical and financial management of aquifers at the local level. The first basin agreement in Morocco was introduced in 2006, for the Souss aquifer, where groundwater accounts for 95% of the total water used. It provides for the installation of water meters for all users, the adoption and enforcement of prohibition measures. In 2016, basin agreements were concluded for three aquifers (Tadla, Haouz, Saïs) as this was one of the World Bank's requirements for a loan.

In line with this point of view, the PMV would not be the cause of the current water scarcity (rather attributable to drought). Access to groundwater, even for the most prudent uses (supplementary irrigation only, limitation to cereals and olive trees) cannot be controlled, given the rural reality, so that the utopian alternatives that can be put forward as a substitute for these expansionist policies are not really practicable.

Viscerally agroecological actions are identifiable. These include solidarity projects that focus on pastoral and agropastoral rehabilitation, as they create an environment conducive to a return to climate-resilient agropastoral systems. These projects are all the more important in a context where the collective lands that were once used as rangelands are mostly distributed and used individually. The PMV has also promoted the generalization of no-till as a flagship measure of conservation agriculture, and wheat varieties have gone to seed quickly, which are more adapted to rainfall deficits. These seeds are produced by the state-owned company SONACOS, which multiplies in partnership with cereal farmers.

The PMV and by extension the GG have placed great importance on the development of palm groves in oasis systems. Oases are a human engineering that reconciles the different dimensions of human development. They are essential to prevent the spread of silting up and halt desertification and are a suitable place to host agriculture and biodiversity. Oases are often organized around date palms grouped in groves and are home to other plants such as PMAs. In addition, oases are an essential component of the national heritage.

For the rest, a large part of the actions are rather eco-efficient in nature. They do not aim to reduce the pressure on the environmental resource, but to make better use of it. The widespread use of the drip irrigation system has been presented as a water-saving alternative to gravity-fed irrigation. It turned out that farmers benefited from the technical optimization provided by drip irrigation to further expand irrigated areas. As a result, water productivity has been significantly improved, but the overall volume consumed has increased significantly.

For its part, the Green Generation 2020-2030 agricultural strategy capitalizes on the MVP to suggest a multidimensional conception, which considers the agricultural sector as a branch of the economy and as a human ecosystem. On the first level relating to agricultural development, the strategy aims to consolidate the agricultural development system supported by the PMV, while making up for the latter's failures such as the enhancement of agricultural products, the restructuring and modernization of supply chains, markets and slaughterhouses.

On a human level, the GG suggested a solution to a historical problem relating to the transfer of agricultural land. Initially, this problem concerns the fragmentation of plots (for private property) and rights of use (collective land) due to inheritance. It also concerns the consolidation/consolidation of parcels of land divided up in the collective domain with a view to making them exploitable and "investable" land by investors, young people or beneficiaries. The GG has consolidated the idea of building a resilient socio-agricultural fabric by being part of the generalization of social protection and by continuing to promote subsidized agricultural insurance for the benefit of cereals, pulses and tree crops. The GG has also focused on entrepreneurship by synergizing with other state programs that encourage agricultural investment through subsidized interest rates, loan guarantees and support for the design and start-up of projects.

In the GG, as in most other strategies in the sister countries, the executives are more absorbed in the present, the object of their mandates, than in the future. The urgent needs of the population systematically take precedence over the challenges of the future, because without the present, the future does not matter. All the actions that can be identified as "non-intensive" are for the most part more climate-resilient than agroecological. Climate resilience means that humans slow down in spite of themselves and adapt, not out of consideration for ecology but out of the search for their own salvation in a situation under constraint.

The main obstacles to agroecological emancipation are mainly cognitive and perceptual. The technical/cognitive constraint is related to the capitalization of knowledge related to agroecology in terms of practice, technique, technology and agroecological strategy. Although the various institutional and economic actors manage to define agroecology as best they can, the fact remains that these definitions are intuitive, and the various examples of agroecological practices are inspired by their experiences. That said, there is no common cognitive reference capital on agroecology. In this sense, while certain practices related to conservation or eco-efficiency are implemented, there is no complete, regularly updated reference system that lists, gathers and details good practices, strategic development principles and ideas, agroecological experiments carried out and scientific findings on this subject. The design of a comprehensive and unified agroecological guide, with a view to its consideration in agricultural policy and its declination into an action plan, would be beneficial.

At the level of farmers' perception, agroecology is reduced to a "slowdown" advocating de-intensification. In the absence of broader knowledge about agroecological alternatives, farmers see agroecology as a call to turn back the clock. Some apple growers we interviewed refuse any agroecological alternative (even if it is viable) if its result is not tied with that of their current speculation. A very large proportion of farmers do not include their concern for the future in the actions of the moment. Religious considerations also play a role in their faith in the return of rains in the future.

8.4.2. The Forestry Strategy

The forest strategy is presented as an inclusive strategy, which considers all aspects related to the forest ecosystem. In particular, it considers the sociology of forest users in the exploitation and participatory management of forest areas, the consideration of forest vocations, as well as environmental aspects such as the preservation of spaces and biodiversity, and the economic exploitation of the forest. The strategy also considers the adaptation of the institutional set-up to accompany the strategy, such as the creation of the Water and Forests Agency, the development of protected areas in the form of national parks and the promotion of research and development.

Morocco's forest strategy seems *a priori* to be complete, subtle in its approaches, and to have omitted nothing at the strategic level. However, the main sectoral shortcomings do not lie in the terms of our strategies but in the institutional receptacle that hosts them and the socio-economic constraints that prevail on the ground.

For example, a territorial diagnosis was carried out as part of the NATAE project in the Daït Aoua area (Ifrane Province). This mountainous, ecotourism area is known for its cold mountainous climate, lakes, and historical availability of water resources. The watershed is home to farming villages, which have recently converted to apple trees under the impetus of financial incentives from the PMV. The villages are demarcated and encircled by a protected forest and listed as one of the 10 national forest parks of Morocco (Ifrane National Park). Although agricultural plots and forest areas are well demarcated and boundaries respected, the massive pumping of groundwater to serve hydroivorous crops such as apples, in a climatic context where groundwater recharge is becoming increasingly scarce, has affected the aquifer, and consequently, the water availability that also serves the forest ecosystem.

This case, among others, illustrates the difficulty of controlling ecological spaces as long as the water resource is common, subterranean diffuse and not geographically contingent. Another interesting aspect is that of the supervision of the forestry sector, which is currently under the aegis of the Ministry of Agriculture, and which, in such a situation of conflict of interest, will tend to favour the immediate social and economic interests of the peasants of this area, especially in the absence of an alternative that is, moreover, commensurate with the income offered by the apple tree.

It is thus a matter of considering that practices are not the only ones that must be agroecological, but also the choice of agricultural speculation, which is now supposed to be "agroecological cultural choices". The agroecological transition should therefore consider, in this unprecedented situation on the scale of current living generations, that the times force us to return to constraint in our production choices. This is not necessarily a question of returning to the "compulsory crop rotations" that were applicable in the 70s, but of encouraging the installation of alternative crops that consume less water and are able to survive in rainfed pipes, such as almond and walnut trees, in parallel with beekeeping, backyard poultry, or a return to extensive farming systems.

Based on the example given, the idea is to design development mechanisms specific to territories where the nexus of agriculture, forestry and ecotourism should be considered as a whole. An integrated government strategy will make it possible to design inclusive territorial participatory projects to bring out alternatives, particularly ecotourism and eco-industrial (light industry such as textiles and agri-food, crafts), to reduce the pressure on water exploitation.

When we go back to the philosophy of any forest strategy, we conceive of the idea that the forest is perceived as a resource (economic component – exploitation of forest products, but under the constraint of preservation) and as an end (conservation and preservation component in itself). Each time, it emerges that the preservation sought at each moment requires the provision of "alternatives" to the beneficiary human groups, which calls for "intersectoral synergy at the territorial level", so that agrotourism, light industry, crafts, services, pastoralism, etc. help to alleviate the financial needs of the population, and thus the pressure on the natural ecosystem.

8.4.3. The Sustainable Development Strategy

The National Sustainable Development Strategy is a comprehensive and inclusive strategy, which considers the 4 pillars of sustainable development which are social, economic, cultural and environmental. Comprising 7 main issues broken down into 31 multisectoral actions, it seems to be sufficiently developed and inclusive at the strategic level, capable of challenging us on the capacities of institutions, with regard to their human, technical and financial resources, to implement it in an applied manner and without omissions.

By its very nature, the sustainable development strategy involves all relevant ministries. An inter-ministerial coordination mechanism has been set up to enable the supervising Ministry, in this case the Ministry of Energy Transition, to coordinate government action on this major project.

What seems, at first glance, to be the weakness of the system supporting this strategy is the bottleneck represented by the responsibility of a sectoral department, which has its own technical challenges, to have to report, as the representative of the strategy, on the sustainability transition of all the other productive and social sectors. Experience has also shown that the governance arrangements that host inter-ministerial action, such as specific inter-ministerial commissions, produce contrasting results, ranging from excellent to mediocre. In reality, the day-to-day concerns of individual Ministries are mainly reduced to the relentless implementation of their sectoral strategy and their social and economic performance, since it is on these aspects, visible, concrete and leading to social peace, that Ministers give priority during and at the end of their mandates.

Hosting a multi-sectoral strategy should be done in one of the following ways:

- A Ministry Delegate to the Head of Government, entirely dedicated to certain inter-ministerial files: In the case of Morocco, the issue of price regulation was very well managed by the Interministerial Commission on Prices, chaired by the Ministry Delegate to the Head of Government in charge of General Affairs and Governance. This experience has also shown that the official involvement of this Ministry, as a signatory of several regulatory texts and conventions on the issues in which it is involved, has earned it a certain respect;
- The explicit, personalised and differentiated injection of the SD strategy into the various sectoral strategies, which will uniquely call on each ministerial department to meet these specific obligations;
- A secretariat of state under the Department of Finance: In the case of Morocco, the Ministry of Economy and Finance, which is a powerful department, has initiated certain reforms in which all authorizing departments have signed up. These include the pursuit of performance through results-based budgeting (project-based budgeting, with results reporting), and gender-responsive

budgeting, which has encouraged authorising officers to consider gender aspects in the design of their projects.

8.4.4. The Water Strategy

- Nuances on the "ecological" nature of the strategies

The water strategy sets out guidelines and ambitions that explicitly take into account the new climate situation. Generally speaking, most recent strategies are sensitive to ecology, but is it 1/ for ecology, and out of long-term vision, or 2/ out of constraint, in the immediate? It is therefore necessary to differentiate between actions to adapt to climate change (actions to safeguard humans), which are immediate, and ecological actions (actions to safeguard ecology), which are for long-term benefit.

The criticality of the current context is putting water and food systems to the test, so much so that the resolution of the immediate problems and challenges that threaten Man takes precedence over long-term ecological considerations. It is therefore expected that most strategies, which have to respond to the emergencies caused by climate change, will implement more climate change resilience actions (for humans) rather than conservation actions (for ecology) which will only have a long-term scope.

Seawater desalination is the perfect example that illustrates the amalgamation between these 2 types of actions. Although it is an urgent response to climate change, seawater desalination has negative negative externalities that are harmful to the environment. The general observation is that societies now find themselves caught in a vicious circle, where responding to the urgency of the present pushes them to undertake actions that are less and less ecological.

The externalities of seawater desalination, in a nutshell

- The techniques used for water desalination are very energy-intensive;
- If the water is captured offshore (salt water requiring a lot of treatment), the effluent is greater and can cause different disturbances to marine ecosystems;
- Marine organisms can bump into the sieving drums and can be sucked into the water circuit;
- The impacts of effluents from these plants are mainly due to the high concentration of salt and to a lesser extent to the presence of chemicals (used for the operation of the plant) and the potentially high temperature of these waters;
- When brine is discharged without dilution or treatment, it induces an increase in salt concentration around the discharge area.
- This phenomenon can also lead to other changes in the environment, namely anoxia and decrease in penetrating light, modifying the biotope and thus the composition of the biocenosis.

- Ecological actions to the detriment of which actors?

In drought years, ABHs rationalize water use to the detriment of the agricultural sector. As a quota of water is reserved for direct human consumption, only the remainder is transferred to the regional agricultural

development boards to supply farmers with surface water at the level of large-scale hydropower schemes. This situation has led in some areas to the uprooting of fruit trees after the accumulation of several years of drought.

The drought has also led the authorities to ban the digging of wells, sometimes allowing the redevelopment of existing wells. In principle, direct restrictions do not distinguish between small and large farmers.

- Good ecological practices

The water strategy includes good ecological practices such as wastewater recycling, which are systematically used in several cities (such as Rabat) to irrigate green spaces. Some practices are intrinsically agroecological, such as price differentiation by bracket according to the volume of consumption. Although this measure basically covers a social objective (tariff equalization between social classes), it carries a price constraint that encourages some households to rationalize. However, this measure remains marginal as the water bill is not so restrictive, and the use of drinking water in the city is not the largest compared to agriculture, which consumes more than 80% of water (all sources combined) in a normal year.

- Climate Change Preparedness

The idea of increasing the size and number of dams, in addition to flexibility and modifying their operation, would be relevant to offset the impacts of climate change on vulnerability to floods and drought – apart from the increase in future water demand, especially in urban centres. It should also be considered that in the long term, a significant number of dams will be old and classified as high-risk dams, which would also require a reflection on the future of increasingly ageing dams.

Other measures such as trade-offs between water releases to maintain flood control stock and drought resilience, ecological flows, water demand (drinking, agricultural and industrial) and energy production will increasingly need to be considered and re-examined in light of climate change, population growth and water technology deployments.

Water policy is aware of the fact that in the current context, conservation alone cannot satisfy the future storage capacity and requirements necessary to meet the future water needs of rapidly growing populations. It has long integrated the rationalization and improvement of the efficiency of water use and the yields of drinking water distribution networks and irrigation water (which is currently done).

Other security actions should also continue to be deployed, such as seawater desalination. This resource, which is considered inexhaustible (but *what about* its energy inputs and ecological externalities), is a strategic choice in a context full of worries and uncertainties related to climate change, when we also consider the opportunities arising from research and technological development in terms of improving seawater desalination techniques and reducing the energy consumption of its plants.

However, in ecological terms (considering the energy involved and the saline discharges into the ecosystem), the majority of scientists agree that desalination should not be considered as a cruising solution, but as a security lever to be triggered punctually, in the event of a crisis.

In this context of climate change, the scientific community is struggling to define the nature of future climate events or their probability of occurrence. To make sound decisions under conditions of uncertainty, the Department of Water must apply a non-traditional approach, which sets aside the ideas of permanence, stability

and absolute options and takes into account multi-optional dynamic planning processes, especially since climate models show a wide range of possible situations in the future.

8.4.5. The fisheries strategy

The Halieutis strategy has given a consistent place to the preservation of the environment, through 3 dedicated projects out of the 16 registered. These 3 projects focus on the scientific mastery of the marine domain, the rationalization of maritime exploitation, in particular through a quota system, and the modernization of the fishing fleet. These actions seem a *priori to* have a very laudable consideration of the sustainability of the marine ecosystem.

Although the mechanisms for controlling and combating the informal circuit have been sufficiently mentioned in the Ministry's report, the strategy would also benefit from the imminent strengthening of the control mechanisms, which condition the results of biological statistics on the exploitation of the resource, the economic performance of the sector, as well as compliance with fishing quotas on the coast and on the high seas. Strengthening control technologies and governance would allow for stricter adherence to exploitation quotas, and thus adopt practices that are more respectful of marine ecology.

Recently, the Parent Department has been working with other relevant government agencies to implement a system of marine protected areas, for which work began in 2020. This measure is in addition to the quota system to strengthen ecological consideration in the marine ecosystem.

It would also be interesting to design, if it has not already been done, "strategic hubs" in which different sectoral strategies, such as liquid sanitation, industry and marine fisheries, intersect, in order to work together to consider the impact of tributary discharge on the marine environment.

In the area of training, sea fishing suffers from certain shortcomings. Some training institutes do not have sufficient resources or adequate profiles to cover the periphery of fisheries training. Some training programmes, by their reduction and shortcomings, reflect the inadequacies of the training resource. The field of private expertise in the field is reduced to a few reference profiles.

As for the ecological and sustainable exploitation component, the training programmes consider the analysis component relating to biological optimization and sustainable development, but this seems to be given in a classic and brief manner, without necessarily embodying a dogmatic revolution sensitive to the new climate and ecological paradigm.

In perspective, on an equal scale, a strong development of intelligent and selective marine aquaculture would make it possible to meet national food needs, at a lower ecological cost compared to agriculture. The factors of conversion of primary biomass to secondary biomass in the marine environment, the absence of water requirements, the surface area, and the virtual absence of chemical inputs are all factors that can elevate, utopianly, marine aquaculture as a very good alternative in the food mix produced by the economy.

8.5. Key Results of the Interviews

Interview 1 / Farmer and market gardener

Identification of the interviewee

Mr. M'hamed Elhouari, from the province of Ifrane, commune of Daït Aoua, Daït Ifrah fraction, is a farmer whom we interviewed during the month of December 2023 during a field school organized in this area. He is a small farmer practicing family farming on an area of 3 hectares of onions and potatoes. He sells his produce at the local market.

How much do you know about agroecology?

It seems to me that these are the conservative practices of the environment, and I have heard some discussions about that. It also includes water-saving and soil-saving practices, doesn't it?

What do you think is the point of agroecology?

It's important to save resources to back them up. At this rate, there will be nothing left for our children to do. We ourselves may be in trouble in the next few years.

Are there agroecological practices on the farm?

Yes, there are practices in the operation. I installed a localized irrigation system thanks to state aid and subsidies from the Green Morocco Plan. It is this plan that has made it possible to generalize wind barriers in the area against hail. I also rotate between crops so as not to deplete the soil and I also let my flock of sheep graze on crop residues in the field.

What are the obstacles to the adoption of agroecological practices?

Lack of knowledge is the main barrier to the adoption of agroecology and since my income comes only from agriculture, I cannot take risks and change my behaviour.

Interview 2 / Medium-sized farmer / specialist apple grower

Identification of the interviewee

Mr. Mustapha Elkouri, from the province of Ifrane, commune of Daït Aoua, Daït Aoua fraction, is an apple grower whom we interviewed during the month of December 2023 during a field school organized in this area. He operates an apple orchard with an area of 5 hectares, and sells his production to buyers.

How much do you know about agroecology?

I had attended a training course for farmers by the Agricultural Advisory Centre on Agroecology. I presume it is the act of cultivating the land without harming the environment through chemicals and reducing reliance on agricultural inputs.

What do you think is the point of agroecology?

The interest, in my opinion, is to be able to live from our ecosystem while preserving it for future generations.

Is it a constraint? A necessity? What for?

To tell the truth, I am an apple grower and apple growing requires frequent treatments and a significant amount of water to have good quality fruit. Even if I wanted to reduce the quantities I brought in, I have no room for manoeuvre. I don't see an agroecological solution that suits me.

Are there agroecological practices on the farm?

There are no agroecological practices on the farm since, as I explained, my crop choice requires intense treatments to ensure a good production that can be marketed afterwards.

What are the impacts? What are the support needs

With the soaring prices and the current situation, I am trying to ensure a better life for my children, a good education and it is certainly not with these agroecological practices that I am going to achieve this in the current circumstances. In the absence of a comparable alternative, I will not change the apple tree as long as I can make a good profit from it at the end of the season. As for the future, we'll see between now and then. If the future requires me to change course, why would I willingly do so today?

Interview 3 / Representative of a cooperative

Identification of the interviewee

Mr. Abdourahmane Fikri, from the province of Ifrane, commune of Daït Aoua, El Hajjaj fraction, is an apple grower who is a member of the El Hajjaj apple growers' cooperative, whom we interviewed during the month of December 2023 during a field school organized in this area. He operates an apple orchard with an area of three hectares, associated with a market gardening of about 2 hectares. He sells his apple production via the cooperative (by aggregation of productions) to a dealer who buys the production and stores it in cold rooms to transport it to Casablanca.

How much do you know about agroecology?

I understand that agroecology is a way of producing that aims to preserve resources and the environment. This is vital and I think farmers will have to get on board.

What is the point of agroecology?

It seems to me that it consists of knowing how to use natural resources for agricultural activity while limiting the damage to the environment. If there is a way to go down that road, we will do it, but it would have to produce as much as our current achievements. If it's equivalent, everyone will follow. Otherwise, I do not think a farmer here will sacrifice himself to leave the resource to others.

Is it a constraint? A necessity? What for?

It is true that our modes of production have led us to this situation. The level of the wells is getting lower and lower, and we are not allowed to dig any more. There is nothing else we can do. Giving up the apple tree and going back to extensive livestock farming like our ancestors would be agroecological as you say, but it does not fit in with a life worthy of the 21st century. Apple farming has allowed us to educate our children and live in good conditions, and it is inconceivable to go back to ways of life where we were satisfied with a few handfuls of lentils and cereals. Times have changed.

Farmers in the region are aware of the alarming situation and the value of preserving the remaining resources and they are very worried about the sustainability of their farms. Most of them would like to find another alternative that is just as profitable and less harmful, but none of them take the risk.

Are there agroecological practices on the farm?

We welcome trainers within the cooperative who have already familiarized us with this concept. Before these trainings, we were not sensitive to these issues. Agroecology can strengthen our resilience to climate change in the area. The locals have ancestral knowledge that can be part of agroecology and I think this will facilitate its adoption. In my case, I converted to apple trees and the chemical treatments made our lives easier. But there are still some practices such as manure rotation and recycling, but it is on a case-by-case basis, each farm is unique.

What are the impacts? What are the support needs

In terms of support, we do need the support of the state and researchers like you to show us how to do it. The cultivation of apple trees, for example, is a difficult crop, and we cannot produce less than 25-30 treatments per year. The benefits of agroecology are certainly significant, but we still need to know how and how much it can bring us.

What are the needs and conditions necessary for the implementation of these practices?

To implement these practices, we need a strong agricultural council, and for the proposed alternative to be economically equivalent to what is currently being done. I don't think any farmer here will make concessions, because any resource saved will systematically benefit those who don't rationalize. These sacrifices must be demanded, they should be demanded of large producers who have more than 50 hectares of apple trees. Collective support for the slowdown must first and foremost be achieved through social justice.

In my opinion, in order to develop this concept, it is necessary to provide both information on the benefits and the benefits, to guide the agricultural council in this direction and to provide aid to encourage adoption and facilitate the transition.

Interview 4 / Responsible at the Ministry of Agriculture

Identification of the interviewee

Mr. Naoufal (surname omitted), is head of department at the Ministry of Agriculture and PhD student. He is conducting his thesis on the social impact of agricultural and rural policies.

What is agroecology? How do you define it?

We can define agroecology as a mode of agricultural production that is sensitive to the ecological issue. It's eco-responsible agriculture in a way. There are several terms that refer to these ecological issues, which we try to perceive through common sense, but the mastery of these concepts belongs to you as scientists.

Is it adapted to the national context?

Many countries have more favourable climatic conditions than ours. What is intensified by irrigation in our country is only rainwater in their country. The low yields in our country force us to be more demanding with regard to what is expected of our resources, and therefore less open to agroecology. When the average farmer in Morocco has less than 5 hectares of land, the social expectations of the farmer are higher than when you have more than 40 hectares under favourable rain. In reality, our social, economic and climatic situation is distancing us from spontaneous agroecology. We must therefore go through an induced agroecology.

Is it a public policy priority?

Agroecology, not in this specific term, but rather, I would say, the agriculture-environment nexus, is considered in the strategy and in our management and development mechanisms for the agricultural sector. We can say that the issue of ecology is a priority in the sense that we have it strongly in our consciences, but you know very well that ecological and socio-economic interests are diametrically contradictory. And in a situation of arbitration, we can't set ecology as an immutable constraint, but we try to find a balance. For some time now, the digging of wells has been prohibited. We (public authorities) know what is at stake, but we are trying to find a balance.

What are the challenges it can address?

It depends on what you're talking about. Agroecology as driven by the experience and spontaneous practices of our farmers has already been acquired. If we ignore the few additional "good habits" to adopt on the farm, I don't think that's going to save us. On the other hand, and this is our lack of knowledge of the subject, if agroecology is much more than that, then we need you to shed more light. In the generic sense, we think we know what agroecology is, but practically, gesture by gesture, what exactly should be done?

What are the policies or measures that address this priority? In what areas?

I also know that we have adopted agroecological practices such as no-till, which is mainly carried out by INRA. With localized irrigation, we make better use of water (although we consume more than before). There are also research and experimentation programs carried out by INRA with institutions such as the IAV Hassan II, the ENA, the University, but in terms of actions, I don't know if there are other more relevant avenues that we need to internalize.

There are also aspects that the strategy cannot really support and control. Traditional arrangements against erosion (e.g. benches) are relevant on a case-by-case basis, and this is done spontaneously by the farmer, without any financial incentive from the State. In the case of unmoderated chemical treatments, how can we control this for the products coming from each farm? The strategy must also be realistic in terms of how it can be implemented and monitored.

What are the constraints and obstacles to the development of agroecology? Technically, economically, socially, institutionally.

If we can summarize the constraints, there is the cognitive constraint: agroecology is a concept, and its consistency should be better declined. Our research institutions are also there to identify them, I should say, but their integration into action plans requires a little more. The other constraint is the social and economic impact of these actions in the short, medium and long term. What concessions should be made in the short term? And how can they be mitigated? Waiting for a long-term ecological return on investment.

Interview 5 / Teacher-Researcher at IAV Hassan II

Identification of the interviewee

Dr. Soufiane El Ayadi, lecturer at IAV Hassan II, specialist in animal production and pastoralism.

What is agroecology? How do you define it?

There are a number of scientific definitions depending on how you look at it, but I would say off the cuff that it is to have a consideration for ecological health in the field of agriculture. It reflects the innate duality between agriculture and its existential substratum.

Is agroecology a subject of agricultural research?

It is indeed a subject of research. A very large part of the subjects include issues of preservation, rationalization, sustainability, sustainability, resilience, efficiency, etc. But as you can see, these questions are addressed under different names, and sometimes they are parts/chapters dealt with in research projects with multiple and integrated objectives, not always at the center of the subject itself. And so researching and identifying work on agroecology is more complicated with regard to the different names and the different degrees of treatment of the agroecological issue in each research.

In the case of animal husbandry, for example, the research topics simultaneously deal with technical aspects, agronomic/pastoral optima, sociological and economic aspects and sustainability in the socio-eco-environmental sense. Dissociate

What are the priorities of agricultural research?

The priorities depend on the person carrying out the research. INRA, for example, has a specific agenda. In the case of higher education institutions, and given that there is not always a budget allocated to research, apart from a few national calls for projects, the themes we carry out depend mainly on the Calls. Most of them bear the aspect of sustainability, or sometimes deal with sustainability per se (as in the case of the NATAE project). The degree to which sustainability and ecology are considered depends on the team and the consistency of its project.

Is agroecology adapted to the national agricultural context?

It's nuanced. Agriculture in Morocco is relatively constrained. Our rainfall balance is low, the availability of land per farmer is low, and our level of self-sufficiency is declining again. All this embrace increases our expectations of our agricultural systems, and thus, our aggressiveness towards the ecosystem.

On the other hand, agroecology can be a way of salvation, if it allows us to reduce our ecological footprint. So it's not that it's suitable (it's more suitable in high-resource areas because the ecological-economic compromise is quickly found), but rather that it's a necessary evil.

Is it a constraint or a necessity?

A distinction must be made between coercive agroecological practices, adaptation practices and non-constraining practices. Coercive practices have an agronomic and financial counterpart, and they are the most

difficult to implement, such as the reduction of chemical treatments and water inputs. Adaptation practices are actually subsistence practices, which are inherently agroecological, and are adopted out of obligation, and in this case, agroecology presents itself as a solution. But it's already a bit late to get to that point. Then non-restrictive practices are those that are beneficial and cost almost nothing, such as the development of water reservoirs that make it possible to fight against erosion and to allow the plantations to benefit from runoff.

What are the obstacles to its adoption?

The barriers depend on each region, but I will say that there are two main barriers. The first is the trade-off to be found between the financial and ecological aspects at the farm level. This is where public policy could intervene through compensation, alternatives, the dissemination of good practice techniques, etc. The second is the compromise between food and economic issues on the one hand and ecological issues on the other. It is therefore necessary to consider the possible counterpart in terms of food security, agricultural value added and exports. Here again, choices should be made between what we should continue to produce, and what we should replace with alternatives that tax our natural capital less. There are leads, but the question is not so obvious.

To your knowledge, are there any agroecological experiences or practices that you have identified in certain regions? Which?

I know of some experiences in the Oriental and High Atlas regions. In the Oriental region, for example, INRA is working in partnership with pastoral cooperatives on the domestication of species adapted to drought and salinity and their planting (by seeding rangelands) as part of the rangeland management programme. They also plant fodder trees and shrubs that serve to provide a pastoral base for sedentary, transhumant and nomadic herds, provide shade and control erosion.

I had also made contact with a farm that practices permaculture. It aims to reproduce local animal breeds, which are certainly not very productive, but very adapted, resistant to diseases and resilient to difficult ecological conditions. The restoration of these breeds is an asset for the resilient agriculture in which we will have to be part of from now on. The manager of this farm believes in the potential of nature. She does not irrigate and believes that if the plant dries out this year, it will adapt its genetic material and come back even more resistant to drought the following year. Its goal is to reproduce specimens that have acquired genetic resilience to drought and salinity.

I was also able to observe some ancestral agroecological practices such as the adoption of legumes as intercrops for nitrogen fixation in the soil, or the practice of "Agdal" which is a resting of the land decreed by the tribe.

Extensive pastoral livestock farming as an ancestral practice is in itself an agroecological practice. In particular, it helps to sequester carbon, and the mobility of herds makes it possible to restore degraded areas by avoiding overgrazing on the same route. According to this allows more time for the resource to regenerate.

Interview 6 / Teacher-Researcher at IAV Hassan II

Identification of the interviewee

Dr. Meriem Seif-Ennasr, Senior Lecturer at IAV Hassan II, specialist in soil sciences and ecology.

What is agroecology? How do you define it?

Agroecology is an agronomic approach that aims to promote sustainable agricultural systems that respect the environment and natural resources. It is based on ecological principles to optimize interactions between plants, animals, humans and their environment, thus promoting balanced and sustainable agriculture.

Is agroecology a subject of agricultural research?

Yes. Agroecology has become a major focus of agricultural research, as it offers innovative and nature-based solutions to address current agricultural challenges, such as sustainability, climate resilience, and food security.

What are the priorities of agricultural research?

Agricultural research priorities include (1) the development of agroecological practices that are adapted to the local context and promote crop diversity, crop rotation, agroforestry, and other agroecological techniques to maximize yields in a sustainable manner; (2) soil conservation, including erosion reduction, increased organic matter, and sustainable nutrient management; (3) preserving and promoting biodiversity, including the protection of beneficial species and ecosystem restoration, as well as (4) assessing the social and economic impacts of agroecological practices on farming communities, including incomes, quality of life and food security.

Is agroecology adapted to the national agricultural context?

Agroecology shows limited adaptability to the national agricultural context, particularly in areas such as Souss Massa where intensive agriculture, based on monoculture and dependence on chemical inputs, predominates. However, in regions where traditional agriculture persists, such as the Rif and the Middle Atlas, agroecology can be more easily integrated. The major challenges lie in the need to adjust this approach to the specific realities of each area, thus highlighting a disparity in adaptation at the national level.

Is it a constraint or a necessity?

Agroecology is both a necessity and an opportunity for Moroccan agriculture. Indeed, in the face of the growing challenges related to conventional agriculture, agroecology is a necessity. By adopting this approach, the Moroccan agricultural sector can respond to sustainability issues, thus contributing to the preservation of natural resources and the reduction of its impact on the environment. In addition, agroecology also represents a strategic opportunity. By promoting environmentally friendly agricultural practices, it offers the opportunity to develop a more resilient, productive agriculture adapted to local needs, thus contributing to food security and the well-being of farming communities.

What are the obstacles to its adoption?

The adoption of agroecology in Morocco faces various obstacles, resulting from a conjunction of economic priorities, lack of awareness, and technical challenges. Indeed, the current goals of Moroccan agriculture, focused on maximizing yields and profits to meet market demands, are a major obstacle to the adoption of agroecology.

Farmers and stakeholders in the sector need to be informed about the benefits of agroecology in terms of sustainability, resilience and environmental preservation. Demonstrating practical successes is key to persuading farmers of the effectiveness of agroecology.

The implementation of agroecology requires technical support. Farmers need support to successfully integrate agroecological methods, highlighting the importance of training and technical assistance programmes.

To your knowledge, are there any agroecological experiences or practices that you have identified in certain regions? Which?

Within our department at the Hassan II Agronomic and Veterinary Institute (IAV Hassan II), we organized a day under the theme "Agroecology and Soil Health" in December 2022. During this event, we had the opportunity to interact with many farmers engaged in the practice of agroecology. In addition, we visited a farm that implements agroecological practices.

To my knowledge, several agroecological experiments have been identified in different regions. These include:

- Network of Agroecological Initiatives in Morocco (RIAM): This network promotes the co-construction of complementary regional networks, encouraging the exchange of agroecological experiences specific to each region.
- Eco-Solidarity Farmers' Markets in Morocco: RIAM offers experiences and good practices, highlighting short circuits of sustainable agriculture through these markets.
- Initiatives at the National School of Agriculture in Meknes: The AGREE research team at the National School of Agriculture in Meknes conducts experiments and awareness programs on agroecology for students and producers in the region.
- Carrefour des Initiatives et des Pratiques Agroécologique (CIPA-Pierre Rabhi): Inaugurated in 2015, this hub, located in the heart of Morocco, is dedicated to the pooling of agroecological initiatives and practices.
- Achievements in the framework of Knowledge Co-creation: Agroecological narratives in Morocco highlight practices and experiences, highlighting the improvement of agricultural production through the valorization of knowledge.

How do you rate these experiences?

These agroecological experiments are generally welcomed for their positive impacts on the environment, agricultural productivity and farmers' well-being. Their assessment is based on criteria such as sustainability, economic and social efficiency, as well as their contribution to food security.

8.6. Conclusion

The agroecology transition is a bumpy path that still suffers from several fragilities. Intensive eco-impacting systems have consequences that are invisible in the immediate future. The direct causality between these modes of production on the variation of natural capital is not obvious, and some of the fluctuations are believed to come from the biospheric "hazard" and the cyclical evolution of the global climate. All these considerations, among others, mean that the perceived effect of environmental (under)performance does not appear specifically and immediately in farmers' incomes, nor in operational assessments, strategy and political mandates. In the absence of an obvious direct imputation of the anti-ecological externality on performance indicators, the ecological issue is the one for which the public is least accountable.

The ecological transition suffers greatly from a lack of scientific capitalization and its dissemination (it would probably also suffer from insufficient scientific progress). How can we brilliantly "green" our practices and strategies, at a lower cost? This is a question that few ideas emerge when addressing the actors, unless we conceive radical actions that discredit social, food and economic emergencies.

One example that reflects the lack of agroecological consensus is poultry production. In the field, this activity does generate discharges that are harmful to the environment. On the other hand, some countries such as India consider poultry farming as an agroecological alternative, because its conversion factor from primary biomass to secondary biomass is among the lowest, as a result, the primary production for which poultry is used as an input is relatively low (less indirect water), and the feed yield is relatively high compared to other sectors, As a result, its environmental efficiency (food output/environmental degradation unit) is well positioned compared to other value chains. However, do these assessments exist and are they known to public development structures?

Ecological awareness is also a very important factor. Farmers are less concerned when it comes to agricultural investors with no emotional connection to the rural territory in which they operate. Consciousness is also diminished when religious faith, which considers the will and divine regulation of the planetary system, erases any sense of guilt about the unreasoned exploitation of natural resources.

The most accepted agroecological practices are those that come from the ancestral agricultural and pastoral tradition. These include the practice of Agdals, pastoral mobility and cereal/legume complementarity systems. State programmes are constantly being deployed to redevelop rangelands (cacti, atriplex, acacia, etc.), particularly in arid and semi-arid areas that rely heavily on pastoral livestock. In the long term, if the climate crisis is confirmed and prolonged, some researchers even envisage the future as a return to the resilient agro-pastoral systems that are currently outdated in the perimeters modernized by the PMV.

The big issue facing the executive when it comes to "designing agro-ecologically" is not conscience or will, but the concessions that come from the dilemma between the socio-economic rendering of the moment and ecological consideration. Is ecologically producing just about producing less? And to what degree? These questions cannot be properly addressed in the absence of a cognitive gap consisting of all agroecological possibilities and their economic and environmental outcomes.

The contribution of scientific research and knowledge management systems is essential and needs to be revisited and internationalized.

Finally, if such a decision is taken, the acceleration of the ecological transition should be supported by a deliberate inflection, driven by two main waves: an "ecological austerity" plan (following the idea of a global consensus advocated by the COP – all countries must adhere to it) and a scientific capitalization for the production of "regional agroecological frameworks".

Chapter 9

National Report for Tunisia

Inès Zouari, Salma Jallouli, Youssef Trifa, Mehdi Ben Mimoun (INAT)

Chapter Nine National Report for Tunisia

9.1. Background

Tunisia is a North African country that covers an area of 164,000 km^2, and has 11,850,232 inhabitants (INS, 2024) who are unevenly distributed over the territory: nearly 66% settled in the more urban and industrialized coastal zone and 34% in the interior of the country, more rural and agricultural.

Administratively, Tunisia is divided into 24 governorates that differ in their socio-economic situations.

The Tunisian economy is based on the service sector (60% of GDP), industry (30%) and agriculture (10%).

The country's socio-economic performance and growth have declined in recent years. The budget deficit reached 5.2% of GDP in 2023 while raising the debt to 76.7% of GDP (finances.gov.tn).

9.1.1. The main indicators relating to agriculture in Tunisia

Agriculture is a key sector in Tunisia from an economic and social point of view. It contributes 10.1% to the national GDP, 2.2% of the state budget, 7.1% of total investments, 9.7% of imports and 12% of total exports (Annual Performance Project of the Agriculture, Water Resources and Fisheries Mission 2023). It employs 15% of the working population and provides a fixed income to nearly 470,000 farmers (Mahjoub and Belghith, 2022).

About 34% of Tunisia's population lives in rural areas and depends on the agricultural sector. Family farming and small farmers dominate the Tunisian agricultural scene.

The total agricultural area of 10.5 million ha, i.e., 62% of the total area of the country. It is broken down as follows:

- The cultivable area is 5.25 million hectares, or 32% of the total area of the country, of which 4 million are cultivated
- Natural pastures and grasslands 4.8 million hectares
- Forests of approximately 1.6 million hectares (ONAGRI, 2017)

The irrigated area is 440,000 ha, almost half of which is fruit trees (49%), market gardening (26%) and cereals and fodder (24%).

Agricultural production structures are characterized by their small size and the fragmentation of agricultural properties: about 75% of agricultural land does not exceed an area of 10 hectares (ONAGRI, 2006).

In Tunisia, agricultural land is mainly used for two main types of crops:

– Arboriculture, in particular olive growing, phoeniciculture and citrus fruits, whose surface area is increasing year on year and represents 2,119,200 hectares, i.e., 52% of the cultivated area in 2020

– Cereals, especially durum wheat and barley, which account for 1,113,800 hectares (29% of the cultivated area in 2020).

- Fodder crops, which occupy nearly 0.5 million hectares

- Vegetables (0.15 million hectares)
- Legumes (0.1 million hectares)

The livestock sector also occupies an important place in Tunisian agriculture with a herd of 6,470,000 head of sheep, 1,197,000 head of goats and 606,000 head of cattle in 2020 (INS, 2016-2020).

The last survey on farm structures was conducted in 2004-2005. It affected a sample of 47,700 farms throughout the country (ONAGRI, 2006). Here are its main findings:

- The number of agricultural holdings is estimated at 516,000 units covering a utilised agricultural area of 5.3 million hectares of land
- More than half (54%) of the holdings have less than 5 ha and own 11% of the agricultural area,
- The proportion of holdings of less than 10 ha rises to 75% of the total number of holdings and covers an area equivalent to 25% of the total area.
- Holdings with a surface area of more than 50 ha account for only 3% of all holdings and account for 34% of agricultural land.
- The average number of plots was 1.8 in 2004.
- Compared with 1994, there has been no major change in the structure of the crop area. Cereals represent almost the same proportion of 37% with a total area of 1610 thousand ha, an increase of 5.2% compared to 1994. The arboreal area still represents half of the cultivated area with 2155 thousand Ha.

The role of organic farming in Tunisian agriculture

The organic farming sector enjoys a privileged place in Tunisia's agricultural development strategy and contributed to the food trade balance of nearly 20% of Tunisia's total agricultural exports in 2021 (United Nations Tunisia, 2022). The export of organic products based mainly on organic olive oil and dates made it possible to achieve a turnover of more than 700 million dinars in 2021, or about 212 million euros (United Nations Tunisia, 2022).

In Tunisia, more than 260,000 ha of land reserved for crop production is certified organic (ONAGRI, 2018). These areas doubled between 2010 and 2018. Most of these areas are reserved for olive growing. Moreover, Tunisia is ranked first in the world in terms of areas devoted to organic olive growing. The rest of the land is reserved for other crops such as fruit trees, date palm, cacti (prickly pear and *aloe vera*), cereals, etc.

The number of producers active in this sector also exploded between 2016 and 2018, from 3467 to 7970 (ONAGRI, 2018).

Table 45: Evolution of certified organic areas for different crops (in ha) (ONAGRI, 2018) (according to data from the Directorate General of Organic Agriculture (DGAB)) in Tunisia

Years	2010	2011	2012	2013	2014	2015	2016	2017	2018
Olive tree	119 400	111 750	100 500	123 694	131 525	127 250	147 762	254 411	241 119
Date palms	1020	1100	1030	912	1331	1200	1701	2946	2789
Vegetable crops	310	170	90	76	128	445	90	137	179
Trees	6550	4300	920	4450	2900	2189	4946	11816	11243
Cereals	1400	1500	1210	414	460	430	384	485	1595
AM Plants*	850	1000	820	27046	178	20013	21367	918	777
Cactus**	700	10500	2680	5731	5985	1930	158	4867	3635
Fodder	0	0	0	0	0	0	1878	48	128
Total	130 230	130 320	107 250	162 323	142 507	153 457	178 286	275 628	261 465

**aromatic and medicinal*

***Prickly pear + Aloe vera*

The control and certification of organic products is carried out by public or private bodies approved by the Ministry of Agriculture (CCPB, CRES, ECOCERT, Kiwa, INNORPI or Control Union Certification) (CTAB, 2021). These bodies ensure that the specifications in force for the organic sector are applied by the operators.

The Tunisian government has put in place measures to encourage operators to convert to organic farming. These measures include the suspension of customs duties and VAT on certain inputs specific to organic farming as well as 50% subsidies on:

- the cost of equipment and tools specific to organic farming (with a ceiling of 500 thousand dinars),

- the cost of control and certification for organic farming,

- Costs of analysis, registration and testing of inputs specific to organic farming (ONAGRI, 2018).

In 2023, investments in organic production amounted to TND 10.2 million, with subsidies of TND 3.4 million (APIA, 2023).

By 2030, the Tunisian government plans to strengthen the diversification of organic products by encouraging the production of carob, vegetables, products from the prickly pear and delicatessen value chain, and essential oils, which year after year are positioning themselves on international markets (United Nations, Tunisia 2022).

9.1.2. The constraints and challenges of agriculture in Tunisia

9.1.2.1. Climate Change and Threats

Tunisia has a predominantly semi-arid with irregular rainfall, which can vary from 1500 mm in the far north to less than 50 mm in the extreme south, with the possibility of torrential rains or periods of drought. The recent years were characterised by successive drought episods as a result of climate change, resulting in impacts on production and water reserves.

Tunisia has 400 m^3 of water per capita per year and is below the water stress threshold of 500 m^3 per capita per year. The level of water stress in Tunisia increased to a value of 109.7% in 2020 (Fig 1). Agriculture uses

79% of the global water volume with 2933 Mm^3 used for irrigation in 2019. The drinking water sector uses nearly 19% of resources (MARHP, 2020).

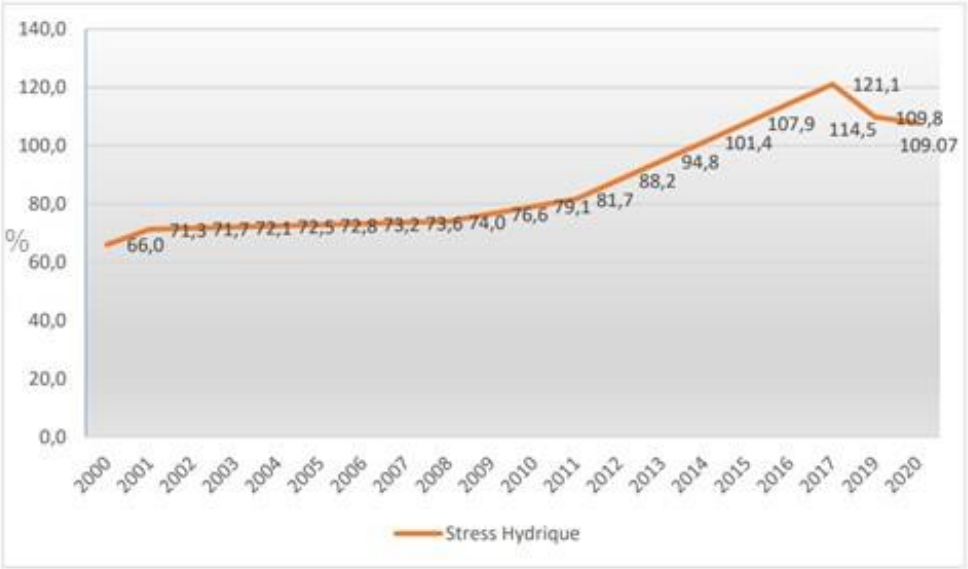


Figure 38: Evolution of water stress in Tunisia (MARHP, 2020)

9.1.2.2. Anthropogenic pressure and degradation of natural resources (land, water and biodiversity)

Soils in Tunisia are generally poor in organic matter. On average, it does not exceed 0.5%, resulting in a very low level of fertility. This level has an impact on crop productivity, which is often improved by the excessive use of mineral and especially nitrogen fertilizers, leading to a degradation of soil structure (FAO, 2017). Land degradation is exacerbated by poor agricultural practices such as monoculture or deep ploughing (Chebbi *et al.,* 2019).

Vulnerability to erosion is also another problem of Tunisian soils. Erosion has a negative impact on agricultural productivity and dam storage capacity (Chebbi *et al.,* 2019).

Groundwater is the main source of irrigation water; They are used in an abusive manner with an exploitation rate of 118% for surface aquifers and 129% for deep aquifers. This overexploitation has led to a drawdown of water levels and the deterioration of water quality (MARHP, 2020). Salinity is the determining factor in the quality of irrigation water, it is less than 1.5g/l for 72% of surface water. In contrast, approximately 80% of all exploited groundwater resources have salinity levels above 1.5 g/l (MARHP, 2020).

9.1.2.3. Food dependency and the coverage ratio by the national production

Tunisia is an exporter and importer of agri-food products. However, the agricultural trade balance has rarely been positive and the country is dependent on world markets for commodities such as cereals, sugar or vegetable oils. At the end of October 2023, the coverage rate was 85.7%, which represents an annual deficit of 912.12 MD. These figures show an improvement compared to the year 2022 when the deficit was 2046.3 MD

and the coverage rate was 69.1% (ONAGRI, 2023). This improvement is due to a 20.4% increase in the value of exports, particularly of olive oil (54.3%) and a 3% decrease in the value of imports, mainly cereals (-9%) and vegetable oils (-26.7%).

More than half of Tunisia's imports by value are cereals, including wheat, barley and maize. Tunisia also imports vegetable oils, sugar, milk and derivatives, meat, etc. (Fig 2).

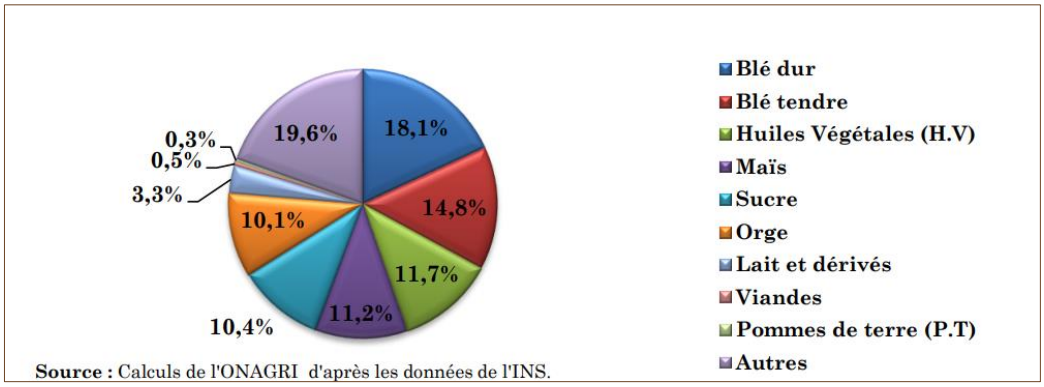


Figure 39: Value shares of the main imported products in food imports at the end of October 2023 in Tunisia (ONAGRI, 2023)

Between 2011 and 2021, the foreign dependency ratio for cereals ranged from 40.8% (in 2011) to 65.8% (in 2016).

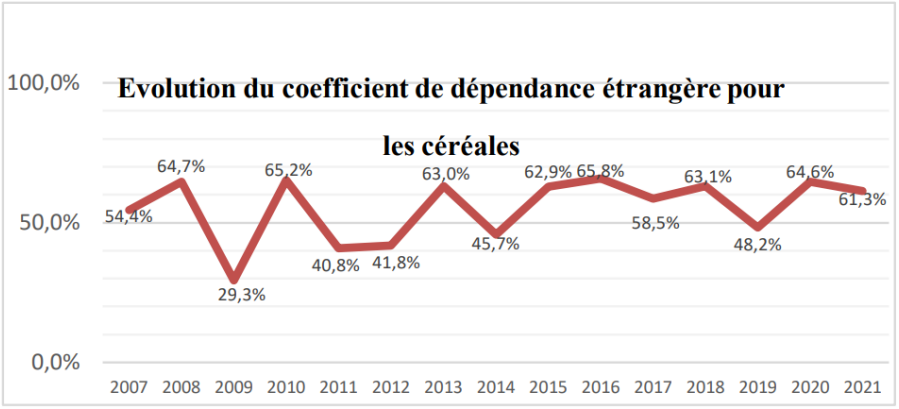


Figure 40: Evolution of the foreign dependency coefficient for cereals in Tunisia (ONAGRI, 2022)

In 2023, cereals accounted for more than half of food imports; In terms of quantities, Tunisia imported 809,400 t of durum wheat, 945,700 t of soft wheat, 693,200 t of barley and 801,600 t of maize. With the exception of soft wheat, where imports fell by 16.5%, all other cereals saw increases in imports of 83.4% for durum wheat, 24% for barley and 9.4% for maize. Despite this, the value of imports decreased by 9.4%, due to the decrease in the import price in 2023 compared to 2022 (ONAGRI, 2023).

Olive oil occupies the largest share of food exports by value (51.4%). Tunisia also exports dates, fishery products, other oils and derivatives as well as a variety of other products (Fig 4).

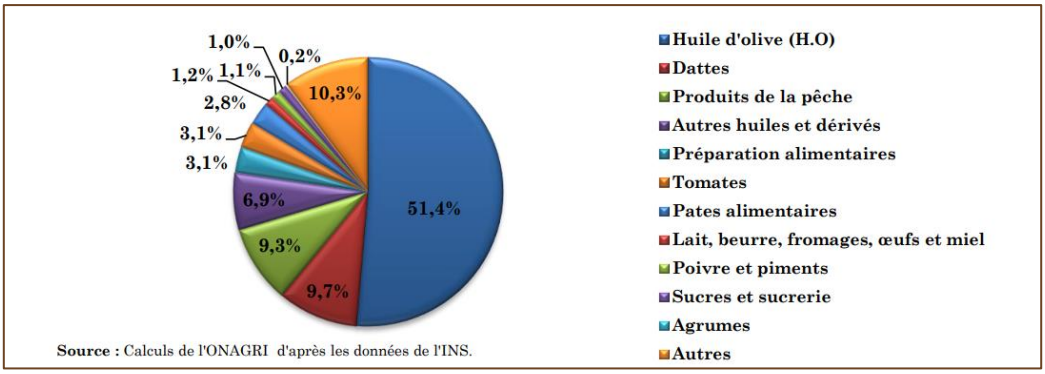


Figure 41: Value share of the main exported products in food exports at the end of October 2023 in Tunisia (ONAGRI, 2023)

9.1.2.4. The crisis in world markets (rise in the prices of inputs, imported raw materials) and its effects (price inflation, rising food bills, etc.)

According to a World Bank report published in 2023, agriculture is the main driver of the economic slowdown that the country suffered in 2023 (World Bank, 2023).

In recent years, Tunisian agriculture has been confronted with concurrent crises that have led to a decline in productivity, dysfunctions between supply and demand, a drop in farmers' incomes, job losses, etc. (Compact, 2023.)

These crises are essentially i) the climatic constraint, and mainly the succession of years of drought associated with long periods of heat, sometimes reaching historical records ii) the Covid-19 health crisis and its serious consequences on the global and national economy and iii) the food crisis resulting from the war in Ukraine. This war has indeed pitted the main producers and exporters of cereals against each other and has led to disruptions in wheat production and trade with the decrease in the quantities traded and the rise in prices: for example, the price of wheat reached 422 Euros per tonne on Euronext on 8 March 2022, That's two and a half times the price of 2020, before falling relatively since then. About 60% of the wheat consumed in Tunisia comes from Ukraine and Russia; It is therefore not surprising that the war has had a direct and substantial impact on food security in the country. In addition, there have been disruptions in transport and logistics operations and the explosion in input prices, especially those of nitrogen fertilizers, whose prices have tripled since January 2022 (FTDES, 2022).

9.1.2.5. The challenges and issues of the future

The preservation of biodiversity, natural resources and ecosystems is a crucial issue. The latter are increasingly vulnerable to the effects of climate change (changes in ecosystems, accelerated degradation of soil and vegetation cover, etc.) and to anthropogenic pressures (land use and artificialization, pollution, pastoralism, forest fires, etc.) (Desertification Strategy). In Tunisia, three million ha (47% of agricultural land) are threatened

by erosion and between 10,000 ha and 15,000 ha are lost annually due to erosion. The country's water resources are low and limited, with less than 430 m^3 /capita/year, classifying Tunisia as a water-poor country (ONAGRI, 2019 ONAGRI Newsletter). Groundwater is overexploited, with exploitation rates of 118% for surface aquifers and 129% for deep aquifers.

The study by the Ministry of Agriculture (Directorate General of Forestry) puts the annual economic impact of environmental degradation on natural capital at nearly 2.69% of GDP (DGF & World Bank Group, 2015)

These phenomena are accentuated in regions already classified as the poorest in the country and lead to an increase in spatial inequalities, unemployment, rural exodus and migration. For example, the governorate of Siliana was ranked as the most repellent and migrant-emitting governorate with 5.1 people per 100 inhabitants (Desertification Strategy)

If adequate solutions are not implemented urgently, these phenomena risk further weakening food security and sovereignty and severely affecting the incomes and living standards of thousands of vulnerable people.

9.2. Strategies Adopted

9.2.1. The Agricultural Strategy

Several agricultural policies have been implemented in Tunisia since independence and since the 80s of the last century, imposing a liberal orientation with, among others, the establishment of the APIA (1983) in order to support the private sector coupled with a gradual disengagement of the State from support for agriculture, such as the supervision of farmers (Ben Bechr, 2016).

Several sectors have nevertheless been developed and Tunisia is thus self-sufficient in several agricultural products including fruit and vegetables, poultry, egg production, and until recently, milk and red meat. Nevertheless, and in a context of climate change and international tensions (COVID-19, war in Ukraine), successive agricultural policies have not provided solutions to several constraints and the consequences are visible in the current agricultural landscape characterized by:

- Low yields, especially of rainfed crops, and their high dependence on climatic conditions
- The volatility of prices, which has a strong impact on farmers' incomes and their ability to maintain themselves as production actors...
- Land fragmentation, with a predominance of holdings of less than 10 ha
- Land tenure insecurity and poor access to property, especially for women and youth
- The dominance of low-income family farming
- Lack of support from the state
- Farmers' poor access to sources of finance ...

Moreover, the absence of a comprehensive, cross-cutting and long-term agricultural policy, which reconsiders development policy choices, has certainly contributed to this regression. Indeed, we can note a sectorialization of agricultural policy with the development of "technical" action plans for sectors in particular such as the water sector (Water 2050 strategy) or agricultural land development (strategy for the development and conservation of agricultural land by 2050).

Rather, horizontal visions are described in the annual performance projects of the Agriculture, Water Resources and Fisheries Mission, which provide a short-term vision.

In general, food security is the pillar of agricultural development policy. It has been more present than ever in agricultural policies in recent years given the difficulties that the Tunisian state has in meeting the needs of its population with basic foodstuffs such as wheat. The Ministry of Agriculture is aiming as a priority to increase production, especially in strategic sectors, as indicated in the annual performance project of the agriculture, water resources and fisheries mission for the year 2023. Programme 1 of this project "Agricultural Production, Quality and Safety of Agricultural and Food Products" has established the following objectives:

- Work to develop agricultural production systems to achieve food security. In this context, the MARHP aims to improve the yield of irrigated agriculture, particularly for durum wheat, potatoes and tomatoes and to achieve yields of 46 qx/ha, 26t/ha and 75t/ha respectively by 2025, through decision-making tools in the field of irrigation and the use of certified seeds of superior quality. For many commodities such as durum wheat, milk and red meat, the goal is to achieve self-sufficiency by 2025.

In order to encourage farmers to improve their durum wheat yields and to ensure that they receive a favourable price, it is planned to revise producer prices for cereals, taking into account changes in production costs but also taking into account the international price of cereals. It should be noted that these measures will encourage farmers to practice durum wheat monoculture, despite the less attractive policies to promote legume crops or all the communication actions of public extension actors aimed at promoting the introduction of legumes into cereal systems:

- Strengthen surveillance, protection, vigilance and health safety systems for agricultural and food products.

- Develop exports of agricultural products by diversifying the products exported (organic products, AOC or IP-labelled products, etc.) and by increasing their added value.

The programme aims to strengthen the positioning of organic farming in the local and national economy and develop the biotourism sector. The goal is for organic exports to reach a value of 800 million dinars by 2025.

The annual performance project of the Agriculture, Water Resources and Fisheries Mission for the year 2023 is based on 5 other programs:

- Fisheries and aquaculture
- Waters
- Forestry and Agricultural Land Management
- Higher Education, Research, Training and Agricultural Extension
- Steering and support

In addition, the strategy to promote the olive and olive oil value chains aims for 2035: (i) the production of 250,000 tonnes of olive oil; (ii) the supply of 50,000 tonnes of olive oil for local consumption; (iii) the export of 200,000 tons of olive oil per year, (iv) the renewal of 1000 hectares of old olive plantations per year.

The Ministry of Agriculture has also put in place several investment incentives:

- Adoption of several investment promotion laws. In particular, the law on private investment, which came into force in 2017, has encouraged the private sector to invest in organic farming, which has resulted in the extension of areas and the conversion of new species to organic farming such as cacti or cereals.
- The creation of an agricultural damage compensation fund to compensate farmers in the event of natural disasters.

In 2023, the value of approved agricultural investments decreased by 25.1% compared to 2022. However, several investments contributing to rationalizing the use of natural resources, such as investments in photovoltaic equipment or water-saving components, have been able to benefit from subsidies of up to 50% of their value. Investments in organic production amounted to TND 10.2 million with subsidies of TND 3.6 million. This indicates the willingness of the State to encourage and support these practices.

In the context of current climate change that has led to the scarcity of water resources in the country, the Ministry of Agriculture has developed a water sector strategy (Water 2050) which aims to preserve water resources, mobilize non-conventional water resources (treated wastewater), improve the efficiency of its use and modernize irrigation equipment used by farmers.

In line with this strategy, and with the objective of ensuring sustainable and climate-resilient management of natural resources, production-oriented and implemented and shared by farmers, the General Directorate for Agricultural Land Development and Conservation (DGACTA) of the Ministry of Agriculture has set up a strategy for the development and conservation of agricultural land by 2050.

In addition to its cross-cutting objectives aimed essentially at (i) the development of common know-how, (ii) the improvement of listening to disadvantaged rural areas, (iii) the establishment of good territorial governance and (iv) regulatory support for the implementation of agricultural land development and the protection of water and soil, the ACTA strategy also had technical guidelines

1. Protection and physical regeneration of soils, with priority given to areas with proven agronomic potential, and improvement of soil fertility
2. Combating gullies in the catchments of large dams and hill lakes destined for reclamation and improving waterways
3. Agricultural and pastoral valorization of ESC developments, support for rainfed agriculture and integration of agroecology
4. Mobilization of runoff water and increase of water storage in the soil, at the surface and at depth (green water and groundwater)
5. Adaptation to climate change, conservation of biodiversity and biomass

The introduction of agroecology (no-till, agroforestry, etc.) and soft techniques as a factor in the success of CES work in areas of cereal arable crops and marginal soils, and the improvement of soil fertility through the provision of organic amendments are operational sub-objectives of these technical guidelines, proving the willingness of

the Ministry of MARHP to apply agroecological practices, especially in areas where soils have been subjected of continuous work that has led to its degradation and the disruption of its imbalance.

9.2.2. Environmental strategies

Tunisia has been a pioneer among Arab and African countries in the establishment of institutions and approaches in the field of environmental protection.

Five-year economic and social development plans began to incorporate the concept of sustainable development as early as 2002. In addition, a Tunisian Observatory for the Environment and Sustainable Development (OTEDD) was set up in the late 1990s within the National Agency for Environmental Protection. OTEDD has developed sustainable development indicators and has carried out a series of studies on sustainability in the various economic sectors.

Tunisia has also acceded to all multilateral conventions and treaties related to environmental protection and sustainable development (ITES, 2016).

The most recent and cross-cutting strategy that shows Tunisia's orientations in the field of the environment is the National Strategy for Ecological Transition (SNTE). It is based on the concepts of environmental protection, sustainable development, adaptation and resilience to the effects of climate change in all sectors of economic and social development. The details of this strategy are described in its analysis (see Chapter 3).

9.2.3. The main climate change adaptation measures adopted

Tunisia published in 2022 a document summarizing the National Low-Carbon Strategy (SNBC) and the National Strategy for Climate-Resilient Development (SNRCC) (Carbon Neutral and Climate Resilient Development Strategy to 2050, 2022).

The resilience component of the strategy is based on cross-cutting and sectoral axes. The objectives of the transversal axes are:

- Strengthening the institutional governance of adaptation in Tunisia, raising awareness and the capacities of actors to plan and implement climate change adaptation actions
- Mobilizing Financing for Adaptation
- Development and dissemination of research and innovation in support of adaptation
- Reducing territorial and social disparities in favour of fairer resilient development

The sectoral axes related to agriculture, natural resources and ecosystems aim to:

- Promot climate-resilient, remunerative agriculture that respects ecological balances
- Transform the fisheries sector to ensure sustainable food security,
- Improve biodiversity governance and providing actors with decent incomes
- Limit the impacts of CC on water resources and transform the management model to meet water needs

9.2.4. The main measures adopted to preserve natural resources

The Republic of Tunisia has developed several strategies aimed at preserving natural resources (land, water and biodiversity). These strategies include:

- The New Strategy for the Development and Conservation of Agricultural Land (2017)
- The National Action Programme to Combat Desertification 2018-2030 (2020)
- The National Strategy for the Development and Sustainable Management of Forests and Rangelands (2015-2024) (2014)
- The Water Strategy 2050 (2022)
- The National Strategy for Ecological Transition (2023)

All these strategies advocate the preservation of resources and ecosystems through actions that aim at:

- Improving the governance and effectiveness of public institutions in managing and preserving these resources
- Combating the degradation of soil and water resources
- Rehabiliting degraded ecosystems
- Conserving and enhancing ecosystem biodiversity
- Improving water use efficiency
- Improving the living conditions of people living in places threatened with degradation

9.3. Analysis of the strategies adopted and the role of agroecology

9.3.1. The Strategies Adopted

9.3.1.1. The National Strategy for Ecological Transition

In 2023, the Republic of Tunisia published its National Strategy for Ecological Transition (SNTE) for 2035-2050 which was developed by the Ministry of the Environment, with the support of the United Nations Development Programme (UNDP). It is a strategy that is based on 5 axes that are broken down into 53 measures. Ongoing or planned activities are described to achieve the objectives of the various measures. These activities therefore have short-term (2023/2024/2025/2026), medium (2035) or long-term (2050) phases.

Purpose & Vision

The objective of this strategy is to ensure the sustainability of natural capital, while improving the efficiency of resources in development activities. It therefore presupposes a transformation of both individual and collective behaviour, through an evolution of production and consumption patterns towards greater sustainability and circularity.

Actors involved

The SNTE is a cross-cutting strategy that has been developed through a multidisciplinary and participatory process. It therefore involves the public sector, the private sector, civil society and citizens. The Department of the Environment is responsible for disseminating the Strategy. All ministries and stakeholders involved will be

responsible for its implementation. The Presidency of the Government plans to support the implementation of institutional, legal and structural reforms and to mobilize all the necessary means for the success of the country's ecological transition.

Guidelines

The SNTE, as a cross-cutting strategy, describes one of the Government's policy orientations, which is the anchoring of the concepts of environmental protection, sustainable development, adaptation and resilience to the effects of climate change in all sectors of economic and social development. Moreover, it covers 5 areas of action:

- Governance and Funding
- Climate Change
- Natural Resources and Biodiversity
- Sustainable Consumption and Production
- Pollution control
- Culture, science and knowledge

Axes

The axes of the SNTE as well as their objectives are as follows:

- Axis 1: Governance and financing: Establish systemic, intersectoral and territorial institutional governance and provide appropriate and accessible financing systems.
- Axis 2: Climate change: Strengthen the adaptation and resilience capacities of sectors, environments and populations with regard to climate change and its effects and reduce carbon intensity to achieve neutrality by 2050, while minimizing disaster risks.
- Axis 3: Sustainable management of resources and ecosystems: Ensure rational management of natural resources, preserve and restore ecosystems (terrestrial and marine).
- Axis 4: Sustainable production and consumption and the fight against pollution: Lay the foundations of the green, blue and circular economy in the context of sustainable consumption and production patterns and eventually eradicate pollution hotspots, decontaminate and rehabilitate polluted sites.
- Axis 5: Science, knowledge and culture at the service of the ecological transition: To develop environmental culture, science, knowledge and the qualification of human resources in the fields of environmental protection, sustainable development and the fight against the effects of climate change and to disseminate these values to the various stakeholders.

The SNTE's axes are divided in 53 measures:

Axis 1. Governance and Funding

Measures
1. Ensure regular analysis and monitoring of the SNTE's cross-cutting indicators

2. Create and set up a High Authority for Ecological Transition (HITE) chaired by the Head of Government, with a regulatory and arbitration role between sectors
3. Adopt the draft Environmental Code and its implementing texts
4. Restructure and strengthen the bodies specialising in environmental matters, both those currently under the Ministry of the Environment (ANPE, APAL, ANGED, ONAS, etc.) and other departments (e.g. the Institute of Arid Regions, etc.)
5. Attach the Tunisian Observatory for the Environment and Sustainable Development (OTEDD) to the Presidency of the Government and strengthen its human, financial and material resources, as a tool for information and support for political decision-making and environmental foresight.
6. Develop a national system of environmental and ecosystem accounting (satellite accounts), as an integral part of the national statistical system (inspiration: UNEP).
7. Develop a new National Spatial Planning Master Plan (SDATN) for 2050, in collaboration with all the departments and stakeholders concerned.
8. Establish an Economic, Social and Environmental Council (EESC) as a consultative and debating forum on development issues, representative of all stakeholders in society.
9. Create an Ecological Transition Fund (FOTE): the FODEP, the Energy Transition Fund (FTE) and the Environmental Protection Tax (TPE) would be restructured accordingly.
10. Create a bank specializing in green finance and a sovereign wealth fund for green investment.
11. Adopt measures to put banking regulation at the service of the green transition, including by introducing a new macroprudential framework.
12. Create a position of special adviser to the Head of State in charge of ecological transition and climate.

Axis 2. Climate Change

Measures
1. Implement the measures called for in the NDC (2021-2030) and the (SDNC-CBI) aiming for carbon neutrality by 2050
2. Implementing the measures of the Energy Strategy 2035

3. Implement sectoral strategies for adaptation and resilience to climate change in agriculture, health and coastal areas, bearing in mind that it is necessary to implement the axes of the National Strategy for Integrated Coastal Zone Management developed in 2020, in support of the ratification process of the ICZM Protocol by Tunisia (December 2022)
4. Accentuate reforestation and forest fire protection actions and engage in the MENA Green Corridor initiative by making Tunisia the hub of the project (leader)
5. Establish a national climate early warning system, connected to international climate early warning networks.
6. Implement the measures of the National Action Plan for the Sendai Framework for Disaster Risk Reduction (SNRRC 2015-2030).
7. Carry out a model action for adaptation and climate resilience: "Kerkennah: island system model for adaptation to climate change and ecological transition" as a flagship project for the preservation of an island ecosystem, climate adaptation and resilience, and the conservation and enhancement of natural and cultural heritage.

Axis 3. Sustainable management of resources and ecosystems

Measures
1. Engage in a water conservation and loss reduction program, including, but not limited to: optimization of irrigation systems, domestic and institutional rainwater storage, reuse of treated wastewater
2. Development of non-conventional water resources, in particular treated wastewater for agricultural or industrial irrigation, and development of related standards
3. Update the agricultural map by including sensitive areas to be protected and introduce agroecology and agroforestry
4. Prepare an action plan for the reduction of the use of chemical pesticides in agriculture and for the elimination of hazardous products and obsolete pesticides and accelerate activities to reduce persistent organic pollutants (POPs)
5. Implement the National Action Plan for the Protection of Biodiversity 2018-2030, including measures for the conservation and reproduction of national genetic resources.
6. Adopt and implement the Blue Economy Strategy, the measures of which concern different actors in various sectors (tourism, fisheries, transport, etc.).

7. Launch a programme to expand marine and coastal protected areas based on the global and Mediterranean target of 30% by 2030.
8. Develop and implement a programme for the rehabilitation of degraded soils, within the framework of the National Action Plan to Combat Desertification (PANLCD) as updated.
9. Committing to Land Degradation Neutrality
10. Develop and implement an action plan for the sustainable development of traditional oases, based on the pilot project carried out in 2018/19 in six (6) oases, with the support of the World Bank (1 in Kébili, 1 in Gabès, 3 in Tozeur and 1 in Gafsa)

Axis 4. Sustainable production and consumption and pollution control

Measures
1. Implement the Energy Transition Strategy for 2035
2. Formally adopt and implement the Strategy for the Integrated and Sustainable Management of Household and Similar Waste (SNGID-DMA) by 2020-2035
3. Restore the system for the collection and treatment of hazardous waste and restart the Jradou centre and related centres and continue the programme for the northern region (Bizerte)
4. Set up a unit to support and accompany investors in the integration of the ecological transition
5. Set up a communication and support program for companies in terms of ecological and societal commitment (as part of the application of Law No. 2018-35 of 11 June 2018 on corporate social and environmental responsibility)
6. Modernize and strengthening precautionary and pollution prevention mechanisms and instruments
7. Generalize tertiary and complete wastewater treatment, with a view to extending it to all wastewater treatment plants
8. Modernize and strengthen environmental monitoring and pollution control mechanisms.
9. Implement the 2035 Industrial Strategy, including green and resilient economy measures and resource efficiency: water, energy and materials.
10. Design and deploy a support program for the integration of the ecological transition within companies and public administrations and institutions (principle of exemplarity of the State)

11. Update the National Environmental Health Action Programme, including epidemiological surveys and monitoring of the health status of populations, especially those most exposed to pollution.
12. Introduce a sustainable consumption tax on all advertising media, with the obligation to display a message on each advertising medium for an ecological gesture.
13. Prepare a roadmap for the depollution and conversion of all hot spots: Gabès, Gafsa, Kasserine, Sfax, Ben Arous, Wadi Medjerda watershed (BVOM), etc.,
14. Implement the National Action Plan for Sustainable Consumption and Production, developed in 2016.
15. Launch a national green building program
16. Develop sustainable transportation: a plan to develop clean, comfortable, safe and accessible public transit, with strong rail penetration.

Axis 5. Science, knowledge and culture at the service of the ecological transition

Measures
1. Establish a permanent and transdisciplinary panel of experts for the study of climate, biodiversity and land degradation, connected to specialized international networks (IPCC, IPBES and Permanent Secretariats of International Conventions): it should have an annual budget to mobilize transdisciplinary experts and to produce and publish quality scientific reports on a regular basis,
2. Introduce a tax for the benefit of research and development (or allocate a share of the VSE to R&D) with a rebate for companies that carry out R&D projects in the fields of ecological transition: this tax could feed the FOCTEE (see measure n° 9) and be used to finance R&D activities and possibly the panel of experts, Bearing in mind that its creation requires close coordination with the Ministry of Finance
3. Launch a programme to upgrade university curricula in environmental science and technology and sustainable development, including the humanities, political, economic and social sciences, in collaboration with the Ministry of Higher Education
4. Design and implement a national vocational training programme leading to certification in green trades, through close collaboration between the Ministry of the Environment (CITET) and the Ministry of Employment and Vocational Training with a view not only to training trainers but also to creating new trades and a specialised workforce, for example through the design and deployment

of a national programme to promote green professions and encourage the development of green trades. Creation of green and eco-innovative start-ups
5. Renovate and modernizing school and preschool teaching and pedagogy in environmental and ecological matters: through close collaboration between the Ministry of the Environment and the Ministry of Education in the revision of school curricula and textbooks, as well as in-service and periodic training of teachers.
6. Grant financial and fiscal incentives to the production of ecological content and to specialized media (TV, radio, social networks, etc.) in order to develop media content to promote the SNTE
7. Develop and disseminate a national platform of sustainable know-how and good practices, with a view to exchange, networking and sharing success stories.
8. Design an inclusive, multi-thematic and multi-targeted national strategy for awareness-raising, communication and education on environmental protection and sustainable development in a context of climate change and ecological transition, coupled with an operational action plan, to be deployed annually on a large scale, via audio-visual media, social media, electronic platforms, field activities, in collaboration with all ministerial departments, the aim is to disseminate as widely as possible and to anchor the environmental culture from an early age.

Agroecology in the action plan

Agroecology occupies a prominent place in the SNTE. The term "agroecology" has been explicitly mentioned twice in the "Sustainable management of resources and ecosystems" axis, but several of the activities proposed in this or other axes refer to some of the elements and principles of agroecology.

The first quote refers to the fact that the SNTE must develop a vision for sustainable and resilient agriculture: agro-ecology. At this level, agroecology has been defined in the strategy as an agriculture "**that goes beyond organic farming and is inspired by agroforestry, in order to ensure food security, social inclusion and the sustainability of natural capital elements: soils, waters, forests and ecosystems.** »

Agroecology was mentioned a second time in the action plan in the third measure of axis 3: "**Update the agricultural map by integrating sensitive areas to be protected and introduce agroecology and agroforestry**".

The following section identifies, in the different axes of the SNTE, the current or planned activities where the elements of agroecology are addressed, whether they are technical, political, social, etc.

Axis 1. Governance and Funding

The activities planned for 2023-2025 could contribute to accelerating and improving the effectiveness of the implementation of an agroecological transition as a component of the ecological transition.

These activities include:

- the creation of the HITE, which is a body chaired by the Head of Government, composed of most ministers, representatives of the main national organizations, the Assembly of the Representatives of the People and civil society, with a regulatory and arbitration role to approve the public policies provided for in the draft environmental code, which includes, among other things, the national prevention policy, protection and rational management of soil and subsoil, groundwater, protection of biodiversity, combating desertification and rational urban management.
- The establishment of ecological transition steering units at the level of each ministry, operational units at the level of each public company, regional and local commissions for the ecological transition via units in charge of the ecological transition at the level of each municipality and governorate
- Adoption of a new Environmental Code to which new principles have been introduced such as non-regression, progress, climate justice, equitable transition... and which mentions the introduction of a mandatory and periodic Environmental Assessment (DEOP)
- The establishment of an Economic, Social and Environmental Council (EESC) as a complementary consultative body to the HITE and the opening of a multi-stakeholder debate on development issues, representative of all stakeholders in society
- The creation of a Common Fund for the Ecological and Energy Transition (FOCTEE)
- Strengthening and diversification of sources of financing and design of new instruments, more adapted to climate emergencies and remediation costs in the event of extreme, recurrent events of still uncertain predictability (storms, floods, fires) or sometimes long-lasting (drought), resulting in severe loss and damage.

Axis 2. Climate Change

The second pillar of the SNTE aims to take climate change into account, through (i) the deployment of the Nationally Determined Contribution (NDC), as updated in 2021 until the 2030 time horizon, (ii) the implementation of the National Strategy for Carbon-Neutral and Climate Resilient Development (SDNC-RCC) by 2050 and (iii) the implementation of the National Strategy for Disaster Risk Reduction (SNRRC 2018-2030).

Ensuring food security and sustainable conservation of vulnerable and productive ecosystems is one of the objectives of this axis. Five key programs have been developed to achieve this objective, namely:

1. Restoration of agricultural soils through integrated actions for the restoration/preservation of land and ecosystems, and optimization of their use

2. Optimization of breeding

3. Improvement of cereal production through actions

4. Good Agricultural Practices (GAP) and Conservation Agriculture

5. Promotion of organic farming

6. Promotion of peasant agriculture, which allows for the dynamic conservation of indigenous genetic resources among farmers, which is essential to ensure the continuity of the adaptation of this germplasm to climate change.

To achieve these objectives, the SNTE has drawn up a list of agro-ecological activities. These include:

- The application of integrated actions for the restoration/preservation of land and ecosystems (not detailed in the document) on 43% of land used in agriculture (by 2050)
- The use of good agricultural practices and conservation agriculture on 342,000 hectares of cereal land (not detailed in the document) (by 2050)
- The use of organic farming on 660,000 hectares (by 2050)
- Coverage of 100% of cattle and sheep by 2050 through livestock optimization actions

Axis 3. Sustainable management of resources and ecosystems

The third pillar of the SNTE concerns the sustainable management of natural resources and ecosystems, which, in their diversity, undeniably constitute the natural capital on which development is based. Their preservation for the benefit of future generations, or even their restoration and regeneration, must now be part of the State's investment effort.

This axis is based almost entirely on the application of agroecological practices through measures such as:

- Better water management
- An update of the agricultural map by integrating sensitive areas to be protected and introducing agroecology and agroforestry
- Reducing the use of chemical pesticides in agriculture
- Protecting biodiversity
- Rehabilitation of degraded soils
- Sustainable development of traditional oases

- **Water management**

Planned activities include:

- the promulgation of the new Water Code, taking into account the measures and recommendations recommended in the Water 2050 study, leading to the development of the Water 2050 Strategy and its Action Plan (2023), which define the future orientations to ensure water security by 2050.

- Strengthening the development of specific areas irrigated by treated wastewater, and improving the quality and transfer of treated wastewater to areas of need. Revision of NT 106.03 (Use of Treated Wastewater for Agricultural Purposes: Physicochemical and Biological Specifications) is also being considered.

- **Reduction of pesticide use**

Planned activities: Substitution of chemical pesticides by natural pesticides derived from plants that respect the environment and are effective in pest control, including evaluation of the interest of forest species with medicinal properties (essential oils and extracts) for crop protection.

- **Protecting biodiversity**

The main objective of this measure is the implementation of the national strategy and its national action plan for the protection of biodiversity 2018-2030.

The secondary objectives are:

- Conservation of ecosystems and biodiversity (habitats and species) and increase in the area of marine and terrestrial protected areas
- Conservation and promotion of genetic resources in national agriculture.
- Repatriation of Tunisian accessions and the integration of these accessions into national agriculture (BNG: Banque Nationale des Gènes)

Within the framework of this second specific objective, a multitude of ongoing and planned activities concern the conservation and enhancement of indigenous varieties. The majority of these actions will be undertaken by the BNG. They include:

- Continuation of the free distribution by the National Gene Bank (BNG) of seeds of the Mahmoudi wheat variety, as well as other indigenous resistant varieties over time, to farmers
- Support for the prospecting and collection of local Tunisian germplasm in order to enrich the collection kept at the BNG in situ, ex situ and with farmers
- Upgrading the conservation process within the BNG to international genebank standards.
- Development and enhancement of the agricultural, medicinal, cultural and social potential of indigenous genetic resources conserved at the BNG in partnership with various local, regional and national stakeholders - Management and sustainable use of forest plant genetic resources through ecological cultivation techniques (NGL)

Other activities involve institutional reorganization or legislative reforms that aim to facilitate the exchange of local heritage between farmers and guarantee its expansion:

- Establish mechanisms for the exchange of genetic resources in order to legally and institutionally regulate the flow of local germplasm at the national and international levels
- Subdivision of the National Gene Bank into community gene banks or by designating regional focal points (antennas) throughout Tunisia. (Focal point by CRDA or by Regional Directorate of the Ministry of the Environment)
- Proposal for a revision of Law No. 99-42 on seeds and seedlings, which is an obstacle to the expansion of indigenous varieties in Tunisian agriculture and consequently contributes to the loss of local biodiversity.

- **Implementation of the National Action Plan to Combat Desertification (NAP-LCD) (2018-2030)**

This measure aims to:

- Restore and rehabilitating degraded soils

- Stop the conversion of forests to agricultural land or other uses
- Increasing the carbon sequestration capacity of forests and soils

- **Sustainable development of traditional oases**

In this area, oases have been the subject of specific measures that are part of the Action Plan for the Sustainable Development of Oases to implement the NSDDO (2014-2030).

Among the objectives of this action plan:

- To lay the foundations for an integrated development of oases at all levels (agricultural, cultural, socio-economic, tourism, etc.) by consolidating their natural and socio-cultural characteristics as a civilizational heritage
- Create an enabling environment for the participation of all actors at local, regional and national level

To achieve these objectives, strategic axes have been established, some of which seek to apply an agroecological approach to the management of this ecosystem:

- Preserve the fauna and flora biodiversity of the oasis through the conservation of local varieties of dates, fruit trees, annual crops and improvement of the integration of family livestock
- Preserve non-renewable water resources and lay the foundations for integrated and participatory management of these resources, optimizing operating systems and water conservation
- Improve the economic profitability of the oasis agrosystem through the conservation of traditional farming techniques, the introduction of innovative agricultural techniques (organic farming, biodynamics, agroforestry, etc.), the improvement of the marketing conditions of agricultural products and a better valorisation of the by-products of the oases
- Promote the socio-economic development of oases, the creation of new employment opportunities and the development of income-generating activities.

Axis 5. Science, knowledge and culture at the service of the ecological transition

The fifth axis of the SNTE focuses on the development of environmental culture, science and knowledge in favor of the ecological transition and the dissemination of its values among all stakeholders. It is also concerned with the production of scientific knowledge, of which scientific research, teaching and education are its main pillars.

One of the main measures established within the framework of this axis is the establishment of a permanent and transdisciplinary panel of experts (academics, researchers, independent experts and representatives of the administration) for the study of climate, biodiversity and land degradation.

Axis 5 also provides for the launch of a programme to upgrade university curricula in environmental science and technology and sustainable development. The activities planned to achieve this objective involve regular exchanges between academics, researchers, experts, etc. on new developments in the fields of the

environment, sustainable development and the ecological and energy transition and the orientation of university and vocational training towards innovative sectors related to the SNTE and with a high recruitment capacity.

Another relevant objective of this axis is the encouragement of the creation of green and eco-innovative start-ups.

In addition, it is planned to develop a national strategy for awareness-raising, communication and environmental education that targets students and public administration officials and executives.

9.3.1.2. National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity

Biological diversity encompasses all species (plants, animals, micro-organisms, etc.) living in a natural environment and interacting with each other and forming a specific ecosystem. Maintaining biodiversity ensures the balance of ecosystems and their sustainability. This biodiversity is constantly evolving. It can be enriched by genetic modification and natural evolution processes, or it can be depleted by anthropogenic activities. Biodiversity loss can lead to the decline of entire populations and their disappearance, threatening ecosystem balances and the resulting services.

Over time, Tunisia has been under many pressures, including forest fires, overgrazing, land clearing and soil erosion, and has consequently lost biodiversity in various ecosystems. The need for a strategy and action plan to conserve biodiversity in the national territory is growing and is one of the Government's top priorities.

The National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Tunisia 2018-2030 (SPANB) was carried out by the Ministry of Local Affairs and Environment (MALE) in 2017 as part of the project "National Biodiversity Planning in Support of the CBD Strategic Plan 2011-2020" funded by UNDP and the Global Environment Facility (GEF).

Vision

Tunisia's vision for the conservation and sustainable use of national biodiversity by 2030 was mentioned in the official strategy document as follows: **"At the end of this strategy (2011-2030), national biodiversity is resilient to climate change, immune from threats and is conserved and managed in a way that contributes sustainably to the socio-economic development of the country** ». In this way, the conservation and sustainable use of national biodiversity would be able to ensure that the value of its goods and services is maintained for present and future generations. These values must be reflected in the economy, politics and society.

Actors involved

The Action Plan for the Conservation and Sustainable Use of Biodiversity involves different actors and stakeholders from the public and private sectors. All the actions of this strategy are initiated and piloted by the MALE in concert with the Presidency of the Government while involving the technical departments and institutions concerned from the other ministries.

Several other actors are involved in the action plan. These actors are: development structures, higher education and scientific research structures, private sector actors concerned with biodiversity (industrialists, traders, craftsmen, farmers, fishermen and hunters, etc.), represented by their professional organizations and finally NGOs and CSOs, including women's organizations.

Priorities for action and objectives

The strategy is structured around 5 priorities for action encompassing the different areas concerned by biodiversity and each aiming at a set of strategic objectives summarised in the following table:

Priority for action	Strategic Objectives
1. Strengthen the capacity to implement and monitor the SPANB	1.1. Establish a national structure to coordinate and monitor the planning and implementation of the SPANB 1.2. Establish a monitoring and evaluation system for the implementation of the SPANB 1.3. Building capacity to ensure a common approach to biodiversity protection under the three Rio conventions 1.4. Mobilizing financial resources (Aichi 20) and integrating biodiversity into sector budgeting
2. Mainstreaming biodiversity values into all national policies and society	2.1. Raise awareness, educate the public and communicate biodiversity worth 2.2. Integrating biodiversity into socio-economic development planning at different levels 2.3. Strengthening Strategic Investments and Partnerships for Biodiversity
3. Developing knowledge and promoting traditional know-how	3.1. Improving and integrating knowledge on the changing state of biodiversity 3.2. Strengthen and federate research on biological diversity and direct it towards the valorisation of knowledge
4. Reducing pressures and threats to biodiversity and promoting its sustainable use	4.1. Reducing the causes of biodiversity loss 4.2. Reducing anthropogenic pressures on wetlands, marine and coastal areas 4.3. Mitigating/preventing environmental threats to ecosystems 4.4. Accessing and Sharing the Benefits of Genetic Resources
5. Protect/restore biodiversity, improve	5.1. Protecting and restoring biodiversity 5.2. Improving ecosystem resilience and maintaining/enhancing ecosystem services

ecosystem resilience and enhance ecosystem services	5.3. Improving ecosystem resilience and maintaining/enhancing ecosystem services

Agroecology in the action plan

Agrosystems and biodiversity are directly linked and are in an ever-evolving mutual relationship. Indeed, agriculture accounts for a major part of the human impacts on biodiversity through intensive agricultural activities (biomass extraction, water, soil degradation, etc.) and major pressures such as: the transformation and standardization of habitats, the emission of gases and ecotoxicity (use of fertilizers and pesticides). On the other hand, maintaining biodiversity in an agricultural environment ensures the sustainability of systems while respecting environmental factors. The adoption of an agroecological system, which takes into consideration the maintaining of more biodiversity on cultivated land, helps to control and reduce the impacts of agriculture on biodiversity.

Agroecology was not mentioned as such in the SPANB document. Nevertheless, through the various actions for the implementation of the strategy, agroecological concepts as well as agroecological practices have been mentioned and detailed many times.

In Action Priority 2, which aims to fill the gaps in the legal and institutional framework that governs the organisation of biodiversity stakeholders, notions of agroecology are mentioned in strategic objectives 2.2 and 2.3 through three actions:

- Integrate biodiversity conservation into decisions on public and private land use through the adoption of a mechanism to compensate for biodiversity losses due to overexploitation of natural space (urbanization and infrastructure). Complementary texts to the Urban Planning Code on rural land use planning will be drawn up and adopted, taking into account the conservation of biodiversity. An agricultural police force (assigned to the technical services of the CRDA or to the municipalities/local authorities in rural areas) responsible for observing and recording violations of the provisions of the supplementary text in question has been established.
- Integrate biodiversity conservation into value chains (biodiversity-based production chains) and encourage private investment in the sustainable conservation/enhancement of biodiversity. This action will be carried out by encouraging and facilitating the emergence of new markets for ecological or green products such as agricultural and fishery products.
- Remove legal and regulatory constraints on the promotion of public-private partnerships around the co-management of natural resources and the conservation of biodiversity. This action aims to create an environment conducive to the development of public-private partnerships for the co-management of natural resources and biodiversity conservation in order to remove legal and regulatory constraints on the promotion of public-private partnerships around the co-management of natural resources and biodiversity conservation.

The valoriztion of knowledge and achievements on agroecology is mentioned in Action Priority 3 through the two strategic objectives 3.1 and 3.2. **In objective 3.1,** several actions aim to develop and improve knowledge in the field of ecosystem biodiversity conservation, including:

- Develop and implement a programme to improve knowledge of the biodiversity of arid, desert and wetland areas. This program will focus on: mapping land use at local scales, updating phytosociological studies including plant communities, soil physicochemical properties, plant species status, the establishment of federated research and development programs targeting the analysis of the genetic diversity of species/populations, ecosystem services (such as the agrosystem) and their vulnerability to climate change, Develop integrated research for pilot areas and develop climate change mitigation/adaptation scenarios for the pilot areas under consideration.
- Support and integrate traditional knowledge and innovations in the conservation and use of biodiversity. This programme will include, among other things, the creation of 3 Ingenious World Agricultural Heritage Systems sites, notably in Ghar El Melh, Kerkennah and Jebba, with the support of FAO. At this level, it should be noted that this programme is currently being prepared.
- Improve knowledge and skills related to the effects of climate change and land degradation on biodiversity through: the establishment of specialized training on climate change and land degradation in engineering schools, the mapping of sensitive terrestrial habitats, the establishment and/or strengthening of observation networks on climate change and land degradation, the establishment of research programmes on biological resources and their evolution with climate change for the selection of resistances and/or the possible improvement of their resilience.

In Strategic Objective 3.2, several actions are set out with the aim of strengthening research on biodiversity and directing it towards the valorisation of what has been achieved. In this action, a 10-year national programme for biodiversity research will be developed and will serve as a guide, or roadmap, for research and knowledge development activities on biodiversity. This program brings together various sub-programs directly related to agroecology, including:

- Research for sustainable agriculture, which will focus on: the development of genetic resources and associated traditional knowledge, research on integrated biological pest management, research on the effect of weeds on the improvement of agricultural biodiversity, molecular marker-assisted improvement, in particular for the creation of cultivars adapted to extensive cropping systems (field crops: cereals and pulses), deepening knowledge of agricultural production systems and their effects on the components of biodiversity with a view to identifying and proposing ways to improve their sustainability/viability while eliminating their effects on biodiversity.
- The valorization and popularization of research results
- International cooperation and technology transfer projects in the field of biodiversity conservation and enhancement.

In practice, it is proposed that the programme should be developed within the framework of a study implementing a consultation process involving working groups made up of representatives of entities and institutions involved in biodiversity research, and coordinated by two experts/consultants in the fields of scientific research and biodiversity.

In Action Priority 4, the concepts of agroecology are widely mentioned and detailed. Within this action, the action plan aims to reduce pressures and threats to biodiversity and promote its sustainable use. These concepts are mentioned through the 4 strategic objectives of this action and are summarized as follows:

- Develop and implement a programme to support the promotion of sustainable agricultural practices that promote the conservation of local biodiversity. This programme will focus in particular on:
    - A typology of agricultural production systems in the different agro-ecological zones that will be evaluated and diagnosed to identify and evaluate options to imprive their sustainability. Such options will include, new land use systems and agroecological technical packages that would be able to improve the ecological and economic yield of production systems
    - The identification and implementation of incentive measures for the adoption of the identified options and practices, as well as regulatory disincentives and/or incentives relating to the abandonment of agricultural practices that directly or indirectly affect biodiversity
    - Awareness-raising, technical training and outreach to promote dissemination and adoption and implementation of relevant options and practices
    - The development of guides for farmers to take biodiversity into account at farm and landscape scales. This action will be implemented in part through integrated development projects focused on the management of natural resources, in particular the Climate Change Adaptation Programme for the Rural Territories of Tunisia (PACTE). In addition, it is proposed that activities related to sustainable land management (SLM) and the conservation/enhancement of local biodiversity be integrated into ongoing or planned Integrated Agricultural Development Projects (IAADs).
- Develop and implement a priority programme for mitigation and adaptation to the impacts of climate change on ecosystems. This program will focus on: mitigating the effects of climate change on agrosystems through: (i) promoting research on the efficiency of using nitrogen and other fertilizers to reduce gases emissions, (ii) integrating climate change mitigation into agricultural development strategies and (iii) adopting regulatory incentives to reduce greenhouse gas emissions and (iv) restoring degraded agricultural land;
- Develop and implement an integrated programme for the prevention and control of pollution in ecosystems. This programme will focus on: limiting the use of pesticides in agrosystems through (i) the identification and conservation of weeds around farms, the analysis of insect fauna, in particular the insect pests associated with them, as well as the parasitoids of these insects and (ii) the strengthening of biological control programmes through the use of weeds on agricultural land.

Finally, agroecological aspects are also mentioned in Action Priority 5, which aims to protect/restore biodiversity, improve ecosystem resilience and enhance ecosystem services. These aspects are integrated into strategic objectives 5.1, 5.2 and 5.3 in the various actions, in particular:

- Strengthen the capacity of the national gene bank (BNG) and other institutions for the characterization and conservation of existing and new plant and animal genetic resources. This action will focus in particular on: An assessment of the existing capacities within the institutions concerned, the definition of the required material and intangible needs, The elaboration and proposal of a roadmap for the organization of work in this field with a view to developing complementarities and synergies between the various institutions concerned and thus avoiding duplication of work and dispersion of efforts.
- Promote the application of the "landscape approach" or the "rural territories approach" to agricultural development projects. This action is planned to protect biodiversity and improve the economic and ecological viability of agricultural systems. Indeed, these approaches advocate, among other things: transformational changes to the landscape and plots based on the adoption of agricultural practices favourable to the conservation of biodiversity (conservation agriculture, organic farming, integrated pest management, etc.), the integration of trees into the agrarian landscape (agroforestry, composite hedgerows as windbreaks), crop diversification and the use of hardy varieties, concerted development of agricultural and rural areas, concerted and optimized management of water resources in irrigated areas and oases, enhancement of local potential for the benefit of socio-economic development through the development of relevant sectors, particularly those focused on local biodiversity.
- Developed in 2015, the action plan for the sustainable development strategy for oases in Tunisia (GDEO) has begun to be implemented through the project for the sustainable management of oasis ecosystems, which is focused on: sustainable management of land and water resources (for the preservation of biodiversity, the maintenance of the genetic diversity of oasis biological resources.

Mobilized resources

The funding of the SPANB 2018-2030, the cost of implementation of which has been estimated at approximately 1150.886 MTD, distributed as follows according to the priorities for action:

Table 46: Resources mobilized under the NBSAP 2018-2030 in Tunisia

	Coût (mDT)			
	Investis-sements	Opérations	Total	%
1. PRIORITE D'ACTION 1 : RENFORCER LES CAPACITES DE MISE EN ŒUVRE DE LA SPANB	2883	10590	**13473**	**1,2%**
2. PRIORITE D'ACTION 2 : INTEGRER LES VALEURS DE LA BIOLOGIQUE DANS L'ENSEMBLE DES POLITIQUES NATIONALES ET	1775	6365	**8140**	**0,7%**
3. PRIORITE D'ACTION 3 : DEVELOPPER LE SAVOIR ET VALORISER LE SAVOIR-FAIRE TRADITIONNEL	2035	8670	**10705**	**0,9%**
4. PRIORITE D'ACTION 4 : REDUIRE LES PRESSIONS ET LES MENACE SUR LA BIODIVERSITE ET PROMOUVOIR SON UTILISATION DURABLE (AICHI BUT B)	49888	358352	**408240**	**35,5%**
5. PRIORITE 5 : PROTEGER/RESTAURER LA BIODIVERSITE ET AMELIORER LA RESILIENCE DES ECOSYSTEMES (AICHI BUT C)	1625	708704	**710329**	**61,7%**
TOTAL SPANB 2018-2030	**58205**	**1092681**	**1150886**	**100,0%**

9.3.1.3. Water 2050 Strategy

STUDI International, in a consortium with GKW, has been mandated by the Ministry of Agriculture, Water Resources and Fisheries (MARHP) to develop the 2050 water sector vision and strategy for Tunisia. The project, financed by the BAD and KFW, is the subject of a contract with MARHP, the project owner, signed on March 28, 2019.

Guidelines

The guidelines of the "Water 2050" action plan are as follows:

- Acknowledging the very adverse effect of climate change will result in more loss of water through evaporation and dumping into the sea;
- Mobilizing resources and satisfying uses will be subject to constraints that are set to become more severe as a result of urbanization on the one hand and the rise of irrigated land on the other;
- "Water saving" will increasingly be the main water resource to be mobilized
- Structurally integrate the situation of aridity, which means that the major axis on which Tunisia should rely on will no longer be surface water but groundwater, and that the best way to safeguard particularly volatile surface water is to transform it into groundwater by means of systematic recourse to artificial groundwater recharge;
- To make the most of its "Waters of the Far North" with superior quality and regularity to be dedicated to the most priority use, that of drinking water, particularly by avoiding the use that has prevailed until now, which consists of mixing good and much worse quality water before spending energy and money to "return to the original level of quality" offered free of charge by nature.

Actors involved

The strategy in question involves several ministries: the Ministry of Agriculture, Water Resources and Fisheries, the Ministry of Economy and Planning, the Ministry of Public Works, Regional Planning, the Ministry of the

Interior, the Ministry of Tourism, the Ministry of Industry, etc. It also involves the private sector, potential operators, civil society, international partners, universities and laboratories.

Fundamental axes or blocks

The action plan is built around 6 Fundamental blocks which are divided into 18 sub-blocks and 9 recommendations:

Block	Sub-Block	Recommendation
Block I. Governance and Rationalization of Institutional and Steering	Sub-Block 1. Operational Plan for the Implementation of "Hydro-Economic Modelling for the Steering and Management of Extremes"	Recommendation 1. for: the "Modernization-Adaptation of Water Governance"
Block II. Drinking Water, Desalination and Renewable Energies	Sub-Block 2: National Programme for the "Allocation of Water from the Far North to the AEP" Sub-Block 3: New National Plan for the Supply and Supply of PE and Irrigation Water in the Rural North-West Sub-Block 4: New National Programme for the Modernisation of the AEP Network Sub-Block 5: National Re-Use Program Sub-Block 6: National Strategy for Brackish Water and Seawater Desalination	Recommendation 2 for: the "Implementation of the National Strategy for the Development of Renewable Energies"
Block III. Integrated Water Resources Management and Food Security	Sub-Block 7. National Programme for the "Extension of Surface Water Collection-Storage" for the upstream accompaniment of IWRM Sub-Block 8: National Plan for "Integrated Surface Water/Groundwater Management" Sub-Block 9: New National Plan for the "Modernization of Irrigation Networks" Sub-Block 10: National Program for "Rationalization of the Operation of Irrigated Perimeters" Sub-Block 11: National Program for the "Agro-Economic Development of Green Waters"	
Block IV: Water Quality, Saving and Safeguarding Ecosystems	Sub-Block 12: "New National Water Saving Plan" Sub-Block 13: "New National Water Quality Plan" Sub-	

	Block 14: "New National Plan for the Protection of Ecosystems"	
Block V: Waters and Territories for Inclusive and Sustainable Development		Recommendation 3 for: "Equity of Access to Drinking Water and Irrigation for Territories" Recommendation 4: for the "Efficiency of Water Uses in the Territories" Recommendation 5: for the "Reduction of Socio-Economic Pressure on Water through Diversification and Rationalization"
Block VI: Objectification through Water Economics, Information Sharing and Regulation		Recommendation 6: for the "Adoption of Good Practices of Objectification by Water Economics" Recommendation 7: for the "Non-Asymmetry of Access to Information" Recommendation 8: for the Promotion of the Participatory Approach to Water Matters » Recommendation 9: for "Territorial Governance of Efficiency and Regulation"

Resources mobilized:

The overall cost of the Action Plan is 73.157 billion dinars, not counting 10.866 billion dinars, or 15% correspond to "Ongoing Projects", Water 2050 being in articulation with the existing one.

The distribution according to the different plans is as follows:

-The 1st Five-Year Plan (2023-2025) corresponds to an investment volume of 3.955 billion dinars, or 5.4%,

- The 2nd Five-Year Plan (2026-2030) corresponds to an investment volume of 12.586 billion dinars, or 17.2%,

- The 1st Ten-Year Plan (2031-2040) corresponds to an investment volume of 29.308 billion dinars, or 40.1%,

- The 2nd Ten-Year Plan corresponds to an investment volume of 27.307 billion dinars, or 37.3%.

The average annual investment of the Water Strategy 2050 is 2.7 billion D, while the overall investment of the State (Title II) is currently 4.3 billion D.

Agroecology in the Action Plan

The elements of agroecology in this action plan mainly concern actions that aim to conserve water resources, avoid waste and improve water productivity.

These actions are multiple and of various types. These include, for example, actions aimed at:

- **Encourage the management of alternating surface water/groundwater supply of irrigated parameters:** when irrigation is in "alternating" surface water/groundwater supply, surface water in a dry year (higher salinity) cut off with groundwater of lower salinity will in the future make it possible to control and soften salinity in general.

Among the means of mobilizing groundwater resources, "underground dams" represent a very good means of combining both efficiency and profitability.

- **Controlling the water footprint in oases:** The aim is to find alternative irrigation systems that improve agricultural production in Tunisian oasis ecosystems, which are currently facing several constraints that threaten their sustainability, due in particular to increasingly scarce water, increased soil salinization, all associated with the trend towards climate change.

One of the water-saving systems is bubbler irrigation (CRRAO Pilot Experiment) which has shown in an experiment conducted by the Regional Research Centre in Oasis Agriculture (CRRAO) an efficiency of water application of 57% while it is 36% and 30% respectively for the underground technique and that by mini diffusers. This technique also produced the best water use efficiency and yields in date palm.

- **Improving water efficiency and saving in irrigated areas**

Several programs are underway or are planned and will be carried out according to the following 3 axes:

- The adoption of "technological and management choices" to reduce water losses,
- The use of water from alternative sources (reuse, storage, harvesting),
- The development and implementation of support policies: awareness-raising, capacity building, pricing, etc.

- **Reinforce the equipment of irrigated areas with water-saving equipment**

Until 2018, the National Programme for Water Saving in Irrigation (PNEE) has made it possible to equip about 405,000 ha of irrigable area out of a planned total of 450,000 ha with water-saving means on the plot.

The objective for 2040-2050 is to equip 99% of irrigated areas with water-saving equipment in order to:

- ❖ Rationalize use and reduce pressure on water resources
- ❖ Improving water productivity

- **Improving water productivity**

One of the objectives is to increase water productivity through improved yields, which could be achieved through improved agricultural practices and rational fertilization. The improvement in irrigated agricultural yields aims to achieve an average yield of 75% instead of the current 50%. At the same time, genetic improvement in terms of rational use of the genetic resources of each species (including cereals: wheat and barley) in order to make the best use of the cultural context, with each approach benefiting from the positive effects of the other.

- **Promoting "Smart Irrigation"**

The Smart Irrigation project consists of the promotion of an efficient irrigation model and an innovative technical assistance service (SAT), for a type of farm able to adopt an automatic irrigation control system, equipped with humidity recording probes, in order to achieve irrigation adapted to the micro-local context.

- **Adopting the REUSE strategy**

One of the objectives of this strategy is to ensure part of the ecological needs by making available about 10% of the total volume of treated water used to supply wetlands.

- **Improving the use of green water in rainfed agriculture**

This will be done by implementing several actions:

❖ Implementation of ACTA (Agricultural Land Conservation Planning) for the filling of the useful water reservoir of the soil

ACTA is a key component of the Water 2050 strategy.

One of the key elements of this plan is the development of benches on the slopes of jebels or hills when the substrate is filtered, in order to control runoff caused by torrential rains, to fill the useful water reservoir of the soil as a priority, also to allow the infiltration of runoff to the aquifers and to limit the transport of material on the slopes.

The ACTA strategy also proposes to adopt a "participatory, territorial, integrated approach to water and soil management and conservation (ESC), involving the target populations of the projects so that they make it part of their territorial approach.

❖ Erosion control

- By revegetating bare land to stop the desertification process by crops integrated into plant and animal production systems (revegetation of steppe rangelands, introduction of native species, introduction of hardy fruit species and pastoral shrubs)
- By improving the adaptive capacities of populations by i) Setting up water reservoirs on farms for better rainwater mobilization, ii) Setting up technical structures for erosion control and water retention; iii) Organic soil amendment to maintain agronomic quality and promote water retention iv) Transmission of knowledge (feedback, observatory of the effects of climate change, etc.) and awareness-raising and initiation of local populations v) Training of farmers in climate-resilient techniques will enable them to appropriate resilience approaches and implement methods to improve their incomes.

❖ Valorization of green water in the "Cereal and Olive Growing Areas of the North of the Ridge"

- The total volume of green water "infiltrable" in the surface horizon of the soil and "storeable" in the useful water reservoir of the soil would amount to 323 million m^3/year.
- The potential developable areas (ACTA) are estimated at 390,000 ha of cereal land and 650,000 ha of olive-growing land, spread throughout the country. Green water resources thus have a production potential of 950,000 qx of cereals (i.e. 5% of the national average production), and 14,500 tons of olives/year (2% of the average annual production).

9.3.1.4. National Action Programme to Combat Desertification (NAP-LCD) 2018-2030

Tunisia, with its Mediterranean and Saharan position, is intensely influenced by the impacts of climate change and governed by an aridity that covers most of its territory. Desertification, land degradation and drought threaten about 80% of agricultural land. Faced with this, the Tunisian state continues to introduce strategic measures to stop this phenomenon of desertification and fight against the rapid loss of land. The main report of the National Action Plan to Combat Desertification (PAN-LCD) aligned with the 2018-2030 horizons, was produced by the Ministry of the Environment. It was carried out within the framework of the project to align the National Action Plan to Combat Desertification with the new strategic framework of the United Nations Convention to Combat Desertification (UNCCD) 2030-2018 funded by the Global Environment Facility (GEF) and the United Nations Environment Programme (UNDP).

Vision

The National Action Plan to Combat Desertification (PAN-LCD) is a normal extension of the policy adopted years ago by the Tunisian government. The PAN-LCD is trying to take stock of desertification in the country, to carry out a critical analysis of the old PAN-LCD of 1998 and to draw the consequences. The PAN-LCD works towards a more prosperous future in which dignified living conditions are guaranteed, natural resources are sustainably managed, the economy is effectively governed, and national wealth is equitably distributed.

Moreover, although it is designed to address the problems of desertification, land degradation, and the effects of drought, the PAN-LCD remains a reference framework of paramount importance for the country, for several considerations. It is a unifying document that does not replace current or planned sectoral strategies and programmes, but it is intended to be a document for the coherence of these strategies and programmes and is in line with the State's sectoral and regional policies.

It is also a document that makes food security a strategic objective and brings important multidisciplinary benefits through the achievements of research, learning, technology transfer and the dissemination of know-how. Its construction will be an opportunity to practice concerted planning and the consolidation of the foundations already established of local democracy and good governance of resources and territories.

Actors involved

The PAN-LCD involves different actors from both the public and private sectors. The operations of this action plan are initiated and directed by the Ministry of Foreign Affairs in conjunction with the Presidency of the Government, while engaging the relevant technical departments and institutions of other ministries.

Several other actors are involved in the action plan. These actors are: development structures, higher education and scientific research structures, relevant private sector actors, professional organizations and finally non-governmental organizations.

Orientations of the PAN-LCD and its objectives

The PAN-LCD is drawn up in two types of guidelines: the **3 technical priority guidelines**, which describe the LCD operations to be carried out within the framework of participatory development plans, and the **2 cross-cutting thematic guidelines**, which describe the instruments for the implementation and monitoring of the

programme as well as the policies that govern the various operations. All these orientations (priority and cross-cutting) are broken down into axes, each axis includes several actions and operations aimed at each specific objective. The specific actions, operations and objectives will be detailed in the section below. The overall orientations and objectives of the PAN-LCD are summarized in the following table:

Guidelines	Objectives
Priority Orientations (POs)	
OP1. Sustainable ecosystems and agrosystems and productive potential of land protected and enhanced to achieve land degradation neutrality (LDN)	• Combating land degradation due to erosion, salinization and land conversion • Protection and development of sustainable ecosystems and enhancement of their ecosystem services • Restoring Degraded Agricultural Land to Achieve Land Degradation Neutrality (LDN)
OP2. Ecosystems and agrosystems that are less vulnerable and more resilient to climate change	• Adapting agrosystems and ecosystems and increasing their resilience to climate change • An effective policy for strategic drought management based on enhanced security
OP3. Promote sustainable rural areas where people's living conditions affected local areas are improved	• Promote sustainable agrosystems that reconcile the exploitation and protection of natural resources, • Improvement of the living conditions of the affected populations and food security • Initiating participatory and inclusive development and strengthening the resilience of populations through reduction or even the neutralization of the perverse social effects due to natural calamities
Cross-cutting thematic operations	
OT1. A new approach to intervention and implementation has been adopted, allowing for the empowerment of stakeholders, synergy with current sectoral strategies and increased social acceptability	• Involve populations affected by desertification in a territorialized development approach and make them participate effectively in the integration of actions • Contractualization of the implementation of the PAN-LCD
OT2. Good governance of natural resources to achieve LDN and combat desertification	• Establishment of an institutional framework to stimulate coordination for better management of the PAN-LCD • Launch a programme to support research, capitalise on and share local knowledge and know-how and anchor it in a process of international cooperation • Implement a Communication and Advocacy Strategy
OT3. Mobilizing financing resources at the national and international levels	• Prioritise innovative domestic financing resources • Applying to the Global Facility "NDT Fund" and seizing international investment opportunities

Agroecology in the NAP-LCD 2018-2030

Through the PAN-LCD, agroecology was highlited in the various priority and thematic operations through the different axes and consequently the different operations.

The **3 priority orientations** aim respectively to : the protection of the environment and natural resources, the strengthening of the resilience of agrosystems and ecosystems to the CC, the improvement of the economy and the well-being of the population. Agro-ecological aspects have been presented in these three guidelines at different levels.

In **Priority Orientation 1**, where actions are oriented towards "Sustainable ecosystems and agrosystems and protected and improved land productive potential to achieve land degradation neutrality (LDN)", agroecology concepts and practices are the subject of the different axes of this orientation, in particular:

Axis 1: this axis aims to fight against land degradation due to erosion, salinization and the conversion of the land vocation, in order to achieve these global objectives, several agroecological practices and notions are implemented through several actions and operations including:

- The protection of land against water erosion through the development and implementation of development projects and the conservation of water and soil (CES) to achieve sustainable agrosystems. In this operation, agroecological practices can be used to enhance the development of CES. As it is generally a technique that only affects extensive and rainfed land, the CES facilities, and in particular the benches (manual or mechanical), offer an opportunity to practice agroecological techniques. The vegetation consolidation of these structures could be carried out by planting and/or cultivation carried out in organic mode to increase the profitability of these developments.
- Protecting land from wind erosion through the development and implementation of silting protection plans. The practices of farmers and agro-pastoralists contribute to amplifying wind erosion. The Aligned PAN-LCD provides for a communication programme to raise awareness and disseminate to the inhabitants of the intervention areas the best techniques in terms of integrated management of soil particle deflation and silting, as well as the restoration of the fertility of land already silted. Among these innovative techniques, we mention the use of fragmented ramial wood (BRF) which can help rebuild soil fertility. Good practice guides should be developed for each type of wind erosion based on local knowledge.
- Protection of agricultural land and irrigated agrosystems (irrigated perimeters and oases) against soil salinization. As part of this action, operations to combat soil salinization in irrigated areas and oases are developed and implemented. The use of drainage and leaching of irrigated areas is therefore one of the techniques to be adopted.

Axis 2: This axis aims to protectand develop sustainable ecosystems and improve their ecosystem services. Always in line with a logic of prevention, the protection of ecosystems and the improvement of their ecosystem services are broken down into a set of actions that recall, among other things, agroecological concepts and practices, mentioned in various operations in particular:

- Develop workshops to model each ecosystem and the biological diversity it contains. This should produce an elaborate knowledge base on the mode and characteristics of functioning of each ecosystem as well as the assessment of its potential for ecosystem services. The aim will be to

develop a baseline for biodiversity and ecosystems, as well as grids for monitoring trends in their evolution, using the most relevant indicators.

- Develop research on specific and/or specific topics/themes necessary to build ecological models, including ecologically oriented agrosystems.
- Remove legal and regulatory constraints on the promotion of public/private partnerships centred on the co-management of natural resources.
- Develop a participatory sustainable management plan for each ecosystem to improve ecosystem services and protect and develop biodiversity.

Axis 3: This axis focuses on restoring degraded agricultural land and ecosystems to achieve land degradation neutrality (LDN). Agricultural areas where land (cultivated or not) is degraded (as a result of unsuitable management methods), eroded (by water or wind power), salinized or flooded, are agrosystems whose "land" support is already more or less degraded and is likely to be more so in the future. Catering is one of the possible solutions to deal with this phenomenon. It should be designed and implemented in an integrated planning process that combines different environmental and socio-economic operations.

Different actions are envisaged by the aligned PAN-LCD to restore degraded land by involving different agro-ecological practices, mainly in the following action:

- The development and implementation of operational plans for the restoration of degraded agricultural land by introducing agroecology for the improvement of soil fertility (organic amendment), this involves the introduction of agroecological practices to restore increased losses in degraded agricultural land or at risk of degradation.

In **priority operation 2,** where overall strategic objective is to establish ecosystems and agrosystems that are less vulnerable and more resilient to climate change, several agroecological practices are required and are involved in axis 1 of this operation, namely:

Axis 1: The main objective of this axis is to make agrosystems and ecosystems adapted and resilient to climate change. To do this, several operations involve agroecological practices or agroecological notions to improve knowledge, these operations can be summarized as follows:

- Develop "*Good Agricultural Practice"* guides specific to each agrosystem. The aim of the guide is to promote ways to use agricultural resources, including land, in a way that is sustainable and provides tangible social and economic benefits to local people.
- Extend to rainfed agriculture some of the advantages granted to irrigated crops in the Water Code. Strengthening the resilience of the rainfed agriculture sector refers to the need to develop tailored solutions as part of a coherent strategy. The aim is to promote agronomic methods relating to the use of water at the local level and to take measures to better manage the variability of production.

In **priority operation 3**, the objective is to promote sustainable rural territories and improve the living conditions of local populations affected by desertification, the agroecology aspects have been presented in the different axes, below is a summary of these aspects by axis.

Axis 1: The objective of this axis is to promote sustainable agrosystems that reconcile the exploitation/protection of natural resources, the improvement of the living conditions of the affected populations and food security. In this axis, several operations are to be undertaken and which partially involve agroecology, among these operations, we mention

- Promote the emergence of value chains that integrate ecosystem services. This operation aims to operationally integrate biodiversity and ecosystem services into value chains (biodiversity-based production chains). This will be done in particular by: encouraging the emergence of new markets for ecological or green products and identifying and encouraging activities/initiatives related to the sustainable development of local biodiversity within the framework of micro-projects or family businesses in rural areas.
- Support affected populations to take charge of the protection of natural resources and ecosystems. This will be done through: Technical and financial support to farmers, women and young people for the improvement of tree cover and the enhancement of their degraded land.

Axis 2: This second axis aims to initiate participatory and inclusive development and to strengthen the resilience of populations by reducing or even neutralizing the social effects due to natural disasters. This will be achieved through a number of specific operations. Agroecological aspects aimed at the sustainability of agrosystems are mentioned in one of these actions, citing:

- Development of cropping systems that are resilient to drought effects and ensure food security for the affected population. This will be done through: the development and implementation of an inventory programme of local water-saving practices, the development and implementation of a scientific research programme on the selection and introduction of plants and seeds adapted to the climate of each region and resilient to CC in other areas,

With regard to the 3 cross-cutting thematic orientations, the concepts of agroecology are also mentioned in the various actions and operations of these orientations. These evocations can be summarized as follows:

In Thematic Orientation 2, which aims to ensure good governance of natural resources to achieve LDN and combat desertification, agroecology has been a topic in the operation that aims to strengthen the capacities of target groups in terms of restoration and enhancement of degraded agricultural land. This action has 4 objectives:

- Transfer practical skills and facilitate the ownership of target groups in the development and implementation of operational plans for the restoration and enhancement of land degraded by

water or wind erosion (including the introduction of agroecology, improvement of soil fertility, pastoral improvement).

- Launch a programme to support research, capitalise on and share local knowledge and know-how and anchor it in a process of international cooperation. Among the priority areas of research, agroecology is at the top of the list.
- Capacity-building and knowledge building in the field of combating desertification through a range of communication and extension operations.

In Thematic Guideline 3, which aims to mobilize financing resources at the national and international levels, one of the actions aims to coordinate with sectoral strategies to achieve synergies in financing at the national level. Among these sectoral strategies, agroecology is at the crossroads of the state's interests. Tunisia is called upon to develop its own channels of financing its aligned PAN-LCD. Among the priority avenues for research in this regard, it is suggested to promote linkages to sustainable development through the integration of LDN objectives into national development policies, which recommends a high level of coordination and political commitment to achieve this anchoring. To further embed this mechanism in LDN and sustainability, financial rewards could be converted into aid/support (technical and financial) to be allocated to local SD projects, such as agroecology, agrotourism, etc.

Another operation in this direction aims to develop innovative financing mechanisms from local sources. There are many investment opportunities to improve land productivity. They include: the reforestation of certain marketable species, the restoration of degraded land, in particular by the development of livestock, the integrated management of sand fixation (biological fixation by species of economic value), the development of sustainable agriculture (organic farming, agroecology, etc.), the development of salinized soils by salt-tolerant crops, the development of activities that enhance the value of peri-urban agricultural land for the development of fight against the anarchic conversion of land, make the most of flooded land with suitable crops, etc. In terms of carbon sequestration, the cultivation of olive trees is a good way to sequester carbon. To this end, encouraging the extension of olive growing areas and densifying existing fields is a good investment that contributes to reducing carbon and appeals to both public and private investors.

Mobilized resources

The PAN-LCD stipulates a multitude of actions and operations of a nature that are sometimes of little or no quantifiable nature. It is a strategy, which covers several areas and involves several actors and which will be broken down into projects. The cost estimate for the implementation of this strategy recommends hypotheses and comparison approaches, which will make it possible to frame the resources mobilized for the various operations. It is then up to the feasibility studies of these programmes and projects to assess the costs more precisely.

The cost of implementing the aligned NAP-LCD to its completion by 2030 is allocated by Guidance as follows:

Table 47: The resources mobilized within the framework of the NAP-LCD 2030 in Tunisia

Orientation	Costs (in 1000 DT)	Percentage of total cost
OP1 Sustainable ecosystems and agrosystems and the productive potential of land protected and enhanced to achieve land degradation neutrality (LDN)	1 784 200	48%
OP2 Ecosystems and agrosystems that are less vulnerable and more resilient to climate change	537 850	14%
OP3 Promote sustainable rural territories where the living conditions of affected local populations are improved	563 000	15%
OT1 A new approach to intervention and implementation is adopted that allows for the empowerment of stakeholders, synergy with current sectoral strategies and increased social acceptability		
OT2 Good governance of natural resources to achieve LDN and combat desertification	607 100	16%
OT3 Mobilizing financing resources at the national and international level	245 000	7%
TOTAL	3 737 150	100%

9.3.1.5. The National Action Plan on Sustainable Production and Consumption Patterns in Tunisia 2016-2025 - Ten-Year Agri-Food Action Plan 2016-2025

The National Action Plan on Sustainable Production and Consumption Patterns in Tunisia 2016-2025 - Ten-Year Agri-Food Action Plan 2016-2025 was carried out by the Ministry of Environment and Sustainable Development within the framework of the SWITCH-Med programme, funded by the European Union.

Vision

The aim of this strategy is to ensure a sustainable food chain that improves economic, social and environmental performance throughout the life cycle of the product. This vision is first and foremost part of an approach aimed at ensuring national food security, but also part of an international process whose objective is to put an end to the overexploitation of resources and to set up sustainable production and consumption patterns.

Actors involved

The action plan in question involves all stakeholders in the food chain: agricultural production, processing, storage/distribution, marketing and consumption. Control structures (ANPE, ONAS, etc.) and civil society are

also involved in this programme. The intervention of the legislator will also be necessary as the action plan includes reforms and the establishment of regulatory frameworks.

Four ministries are responsible for the implementation of the programme, namely the Ministry of Agriculture and Water Resources and Fisheries, the Ministry of Industry, Energy and Mines, the Ministry of Environment and Sustainable Development, and the Ministry of Trade and Handicrafts.

Guidelines

The guidance as explained in the document can be summarized as follows:

- Ensuring the sustainability of the entire agri-food value chain by integrating it into a global vision that includes all its links
- The integration of an approach that aims at the adoption of sustainable practices that are more in line with the social context and local know-how.
- The establishment of more accountable and inclusive governance by strengthening the regionalization of decision-making, thus allowing a better consideration of the specificities of the regions, and by the involvement of the different stakeholders (institutional actors, the private sector, NGOs, local communities) in planning and decision-making by adopting both a top-down and bottom-up approach.
- Implementation of a programme to raise awareness and inform people on concepts related to the MPCD (climate change, clean production, etc.) and to strengthen the capacities of key national stakeholders.

Axes and objectives

The strategy is based on 4 strategic axes:

Axis 1: Ensuring sustainable agricultural production adapted to the industry

Axis 2: Developing sustainable products using environmentally sound processes

Axis 3: Promote distribution channels that promote sustainable products

Axis 4: Promote the culture of sustainable consumption and encourage the selective disposal of waste

These axes have been broken down into operational objectives, which are as follows

Axis	**Operational Objective**
Ensuring sustainable and industry-friendly agricultural production	Rationalize the use of natural resources and reduce sources of nuisance (pesticides and waste)
	Promoting sustainable agricultural practices and local know-how
	Ensuring the viability of agricultural activity

Developing sustainable products using environmentally sound processes	Rationalize the consumption of energy, water and other inputs
	Developing the social and societal aspect at the industry level
	Reducing and recovering waste
Promote distribution channels that value sustainable products	Promote the distribution of products from sustainable production or sourcing methods
	Fighting parallel markets
Promoting the culture of sustainable consumption and incentivizing the selective disposal of waste	Ensuring transparency and dissemination of information
	Anchoring the environmental dimension in consumer behaviour and strengthening selective sorting
	Developing the consumption of labelled products

Agroecology in the action plan

Agroecology is not explicitly mentioned in the action plan. However, the operational objectives and proposed actions refer to some of its elements and principles. In particular, the technical, political (or regulatory) and social aspects of agroecology are the most discussed.

For example, under the first axis, the action plan proposes initiatives related to governance such as the establishment of institutional and regulatory frameworks for recycling practices (reuse of wastewater, recovery of agricultural waste).

The social aspect was also present. These include actions that encourage and enhance connectivity between farmers and industrial farmers (strategic committee) and studies of working conditions in the agricultural sector.

The recommended actions also aim to improve the socio-economic situation of farmers with, among other things, the establishment of regulatory frameworks for financing structures and the regularization of over-indebtedness, as well as the launch of information campaigns on financing.

The technical angle was addressed by the planning of training studies and capacity building around EAPs such as organic fertilization, management of agricultural surpluses and pesticides, water saving and the use of renewable energy, particularly in irrigation and water pumping.

Axis 2 focuses mainly on industrialists. The actions programmed in this area encourage the rationalization of the consumption of the various inputs and to get involved in a social responsibility approach and the development of ISO certifications in order to ensure a certain sustainability of the agri-food sector. Recycling and waste recovery are also among the objectives set for industries given their share of responsibility for water and air pollution. The planned actions include several communication, awareness-raising and capacity-building actions, but also recommend the increase of penalties on polluting industries and the introduction of the polluter pays principle.

Axis 3 aims to promote distribution channels that promote sustainable products and also to fight against parallel markets. The planned actions are the implementation of awareness-raising and training campaigns on good practices in the transport/distribution and storage of agri-food products or of a regulatory nature.

Finally, axis 4, which involves consumers and civil society, has several objectives, including anchoring the environmental dimension in consumer behaviour and strengthening selective sorting through capacity-building programmes. In this area, the action plan also encourages the development of the consumption of labelled products (fair trade, organic, etc.). Actions in this direction include, for example, the integration of sustainability criteria into the contracts launched by schools, canteens and hospitals and the creation of a "fair trade" label that would be recognized internationally. Several promotional, training and capacity-building actions on labelled products (organic and others) are also planned.

Mobilized resources

The National Action Plan on Sustainable Production and Consumption Patterns in Tunisia 2016-2025 - Ten-Year Agri-Food Action Plan 2016-2025 has 4 components:

- A "studies" component
- A "technical assistance" component
- A training component
- A "communication and awareness-raising" component

The overall cost of implementing the plan is estimated at 54 MTD over 10 years, i.e. an average investment of about 5.4 MTD/year.

Almost half of the budget is devoted to actions related to technical assistance (AT) and capacity building programmes.

In concrete terms, the "technical assistance" component is intended to support stakeholders in the implementation of new actions, with recommendations to ensure the financial viability of agriculture (development of microcredit), and programmes to strengthen the capacity of control structures along the links in the food chain. It was also recommended to use a AT to introduce sustainability criteria in the public procurement of schools, canteens and hospitals. The costs allocated for technical assistance are spread over the 4 strategic axes of the action plan and will be mobilized in several actions, including:

- The establishment of a AT to support the establishment of a clear institutional framework concerning the REUT sector
- The implementation of a AT at the MEP of programs for the development of irrigation/water pumping techniques through the use of renewable energies (solar pumping)
- The implementation of a AT at the MEP and structuring of an agricultural waste management sector
- It is proposed to revise the penalties by increasing the amounts and to apply them strictly, including under the polluter pays principle. AT for the revision of the regulations is required.

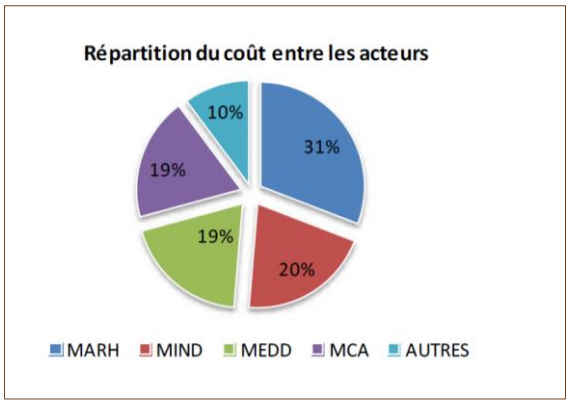
- The establishment of a AT to speed up the publication of the new legal framework for food safety and industrial safety.
- Implementation of a AT in several other areas in the different actions such as: coordination, evaluation, control models,

Table 48: the allocated budget within the framework of the national action plan on sustainable production and consumption in Tunisia

Répartition du coût global (en MDT) du plan d'action par axe/rubrique						
	Axe1	Axe2	Axe3	Axe4		En %
Etudes	1,2	0,37	0,4	0,62	2,59	*5%*
Assistance Technique	11,4	3,9	1,3	8,5	25,1	*47%*
Formation	1	1	3	1	6	*11%*
Communication et sensibilisation	5	8	4	3	20	*37%*
Total	18,6	13,27	8,7	13,12	53,69	*100%*
En %	*35%*	*25%*	*16%*	*24%*	*100%*	

Budget per actor

The budget is divided among 4 ministries responsible for the implementation of the action plan as well as other actors. The highest share of the budget (31%) is reserved for the Ministry of Agriculture and Water Resources and Fisheries.



MARH: Ministry of Agriculture and Water Resources and Fisheries
MIND: Ministry of Industry, Energy and Mines
MEDD: Ministry of Environment and Sustainable Development
MCA: Ministry of Trade and Handicrafts

9.3.2. Existing expertise and information in agroecology

Agriculture in Tunisia is a pillar of the national economy. The sustainability and stability of agricultural systems throughout Tunisia are therefore a primary objective for Tunisia, which is constantly orienting its national

strategies to ensure this. Among the areas on which the authorities are focusing is agricultural education and scientific research, which is led by IRESA (Institution of Agricultural Research and Higher Education). IRESA has been involved in the planning, monitoring and evaluation of research programmes to meet development needs. Among these programs, agroecology and agroecological transition seem to respond effectively and significantly to these needs.

In the various institutes of higher agricultural education, agroecology is taught at several levels (bachelor's degree, engineering cycle and master's degree) with a more or less substantial volume. Agroecology is taught as a whole module or agroecology concepts are inserted into other modules such as organic farming or conservation agriculture. More data will be more available and fully detailed at the end of WP7 task T7.1.

The overall objectives of these courses are:

- Understanding Agroecology: Definition - Different Approaches
- Learn about the agroecological transition
- Understand the operating system of an agricultural business and identify agroecological practices
- Propose agroecological improvements at the scale of a farm business

The following table summarises the agroecology-related modules taught by institute and level:

Institute	**Target Audience**	**Modules**
Ecole Supérieure d'Agriculture du Kef (ESAK)	Engineering Cycle (Plant Breeding and Crop Defense Specialty)	Agroecology (20h class, 10hTP/TD)
Ecole supérieure d'Agriculture de Mateur (ESAM)	Research Master's Degree	Agroecological Approaches (Course)
Ecole Supérieure d'Agriculture de Chott Mariem (ESACM)	Research Master's Degree (Plant Protection and Environment) Research Master's Degree (Sustainable Horticultural Systems)	Sustainability of Agro-Ecosystems (course) Good Agricultural Practices, Sustainable Production Systems
National Agronomic Institute of Tunisia (INAT)	Research Master's Degree (Sustainable and Climate Resilient Management of Agrosystems)	Transition to sustainable agroecological systems Sustainable management of agroecosystems

By 2030, IRESA has established an innovative strategy for agricultural scientific research. The vision of this strategy aspires to "transdisciplinary, innovative, knowledge-producing agricultural research that generates wealth and employment that contributes to the resilience of production systems, food security and the sustainable and equitable management of natural resources". In order to carry out this strategy well and achieve these strategic objectives, the research needs have been set on the basis of a global synthesis of the priority problems involving the various actors and stakeholders in the agricultural field. IRESA has developed the research priorities for the period 2018-2030, the orientation of which corresponds to addressing one of the challenges of the strategy. The orientations of agricultural research adopted, which make use of agroecological concepts, are as follows:

- Orientation 1. Sustainable increase in crop and livestock productivity and production. This orientation aims to establish sustainable production systems in a context marked by the degradation of natural resources and climate change. This program aims to optimize the use of inputs and develop production systems that are profitable, sustainable, resilient and adapted to climate change.
- Orientation 2. Preservation of ecosystems and sustainable management of natural resources. This research orientation aims to better exploit and enhance natural resources in a context of climate change (water, soil, biodiversity). This programme is supposed to provide technical, institutional, social and economic options to counteract the pressure on natural resources. Integrated natural resource management based on participatory, systemic, holistic and inclusive approaches should be targeted by research.
- Orientation 3. Preservation of pastoral and forest resources. This orientation focuses on the sustainable management of pastoral and forest resources. This programme aims to find the necessary solutions for the rational use and sustainable management of rangelands and forest areas and to make effective use of forest products without degrading forests and rangelands.

Several non-profit organizations have been working in the field of environmental agriculture for years. Examples of these organizations include:

- The Tunisian Association of Environmental Agriculture (ATAE, founded in 2011). This association is constituted as a network for the transmission of knowledge, experience and skills in the field of agriculture for the protection of cultivated soils and natural ecosystems in order to ensure the sustainability of resources and the mitigation of the effects of climate change.
- The Tunisian Permaculture Association: it was created in July 2015 with the objectives of disseminating permaculture, its spirit and techniques, to put networks among its actors and to develop permaculture projects in Tunisia.

In addition, several research and development projects on agroecology or similar themes have been carried out in Tunisia and particularly in Siliana. Through the activities undertaken within these projects, a dynamic has been created in the target areas that has led to an awareness of the risks associated with certain conventional farming practices and the adoption by some farmers of cropping practices that improve the sustainability of their system. The following is a non-exhaustive list of these projects:

- **PACTE (2019-2024)**: "Climate Change Adaptation Program for Vulnerable Territories in Tunisia" Rural Territories Development Project led by DGACTA for the Ministry of Agriculture. It includes an action-research component led by CIRAD and its local partners, INAT and INRGREF. The agro-ecological transition in these territories is an important component of the project. Target areas: Bizerte, Kairouan, Le Kef, Sidi Bouzid and Siliana)
- **PROFITS (2020-2024):** "Siliana Territorial Development Value Chain Promotion Project" Development project led by the DGACTA in collaboration with the OEP, where the sustainability component of natural resources and agro-ecology is essential. Target Area: Siliana

- **Conserve terra:** PRIMA project "Towards Conservation Agriculture in the Mediterranean Area" Icarda, INGC and INRAT: with a component that focuses on farmers' behaviour in relation to no-till.
- **Prosol (2019-2024):** Soil Protection and Rehabilitation to Improve Food Security: Promotes soil-conserving crops and stops erosion by stopping land ploughing. GIZ/Ministry of Agriculture. Target areas: Kairouan, Sidi Bouzid, Kasserine, Siliana Béja, Jendouba and Le Kef.

9.3.3. Obstacles to agroecology

The obstacles to the agroecological transition are numerous and of different natures. Here, we mention some of the most important ones:

- There is a lack of knowledge about agroecology in general, of its medium and long-term interest in the farming community. Some of the pillars of agroecology are widely known and popularized, such as the importance of rotations in cereal production systems, but information remains fragmentary and only a minority of actors have an exhaustive knowledge of the different components of agroecology. To a certain extent, this lack of knowledge also extends to agricultural advisers and even to the support services of the Ministry of Agriculture. As a result, there is still relatively little training dedicated to farmers to encourage them to engage in an agroecological transition.
- Difficulty in accessing no-till seeders. A survey in 2016 showed that the non-availability of the no-till drill was the main cause of farmers' return to conventional seeding, according to a study initiated as part of a "Conservation Agriculture in the Maghreb" project on no-till in Tunisia. This constraint is exacerbated by the low rate (6%) of farmers joining professional organizations (in Tunisia: Sociétés Mutuelles de Services Agricoles and Groupement de Développement Agricole). However, these organizations should be able to play a crucial role in extension, the choice of orientations, or the pooling of resources and the provision of agricultural equipment to their members, as is the case with no-till seeders.
- The non-adoption of complementary agroecological combinations. For example, the drop in yields after a few years of no-till is also a main reason behind the abandonment of no-till by some farmers. This is mainly due to the problems of compaction and hydromorphism that affect untilled soil when no prior actions to improve soil structure and drainage capacity have been undertaken.
- There are technical barriers associated with TAE that are still only partially resolved, such as weed management in agriculture with reduced herbicide use. Combined with the lack of a dedicated extension programme for the agroecological transition, these technical barriers limit the adoption of agroecology by farmers.
- In addition, there are very few dynamics for the creation of value chains or added value around agroecological products.
- The State's strategic orientations and agricultural policies have direct effects on the trajectories and dynamics of agricultural development. Some of these policies limit farmers' adherence to agroecology, and there are many examples of such policies. (i) Thus, and following the gradual disengagement of the State from agricultural extension associated with farmers' poor access to finance, input dealers play the role of advisers and do little to encourage the implementation of a dynamic of input reduction. In addition, (ii) the State, through its policy of compensating cereal products, guarantees producers the

purchase of all their cereal production (durum wheat, soft wheat and barley), thus promoting the monoculture of cereals. It should be noted that the areas reserved for legumes have been steadily decreasing, from 102,000 ha in 1994/1995 to nearly 70,000 ha in 2019/2020 (ONAGRI, 2020) (iii) The State also intervenes in setting the price of certain locally produced fertilizers (phosphate fertilizers and ammonium nitrate) promoting their use.

- There are also some cultural barriers, such as the long-standing practice of grazing crop residues on cereal fields by livestock farmers, which does not make it easier to maintain permanent soil cover.

The statistical bulletin on private agricultural investments published in February 2023 by APIA (the agricultural investment promotion agency) indicates a 25.1% decrease in value of agricultural investments approved in 2023 compared to 2022 and 28% compared to the 2016-2020 development plan. A decrease in the number of operations of 11% compared to 2022 and 32.4% compared to the 2016-2020 development plan was also recorded. There are several reasons for this decline in investment, including the uncertain outlook for agriculture due to climate change and prolonged drought and the difficult financial situation of some farmers who are struggling to find the necessary financing for new investments. It should be mentioned that the value of grants and land loans has also declined, indicating a decline in the State's participation in the financing of agricultural projects.

Even though these figures relate to investments in the agricultural sector in general, the business climate does not encourage farmers to adopt innovative practices that involve a certain amount of risk-taking.

9.4. Key Findings of the Stakeholder Interview Guide

9.4.1. Objective and methodology used

This part is devoted to interviews with the various actors involved in the fields of agriculture, the environment, research and training. The objective of these surveys is to assess the perception of the notions of agroecology and agroecological practices by the different actors.

In order to carry out this part, different surveys were developed, each survey was reserved for a category of stakeholder. The categories targeted in this section are: farmers in the different regions of Tunisia, researchers in the field of agronomy and the environment, representatives of public authorities, representatives of professional organizations in the field of agriculture and finally representatives of non-profit organizations (NGOs) that work mainly in the field of agriculture and the environment.

Interviews with farmers were conducted face-to-face in order to facilitate understanding of the various issues and to simplify scientific and technical concepts where necessary. Surveys of other stakeholders, including researchers, government and professional representatives, and representatives of NGOs, were conducted online. The surveys were disseminated to these stakeholders in order to collect as many responses as possible.

In the category "representatives of professional organizations", the responses collected were not sufficient to develop a meaningful analysis of perceptions. This category is not mentioned in the results section of the surveys.

9.4.2. The results of the surveys

Surveys were conducted among stakeholders in the field of agriculture and the environment. The aim of these surveys is to get a global idea of their perception of agroecology. Four categories of actors were involved in these surveys: farmers, researchers, representatives of NGOs and representatives of public authorities.

The results of the survey of researchers

These surveys were carried out among research professors in the various agricultural research institutes in Tunisia, in particular: the National Institute of Agronomic Research (INRAT), the National Agronomic Institute of Tunisia (INAT) and the Regional Center for Agricultural Research of Sidi Bouzid (CRRA, Sidi Bouzid).

All researchers questioned gave definitions of agroecology that are close to the following definition: "Production systems that respect the environment". Only half of these researchers have had experience in agroecology. These experiments were mainly in the regions of Siliana and Kairouan (92%) with small farmers with limited means, and in the region of Sidi Amor (8%) in agricultural development groups.

These researchers all endorsed the relevance of agroecology as a topic of agricultural research due to the current context of climate change and natural resource scarcity. When asked about the current priorities of agricultural research, the answers were very diverse: the majority (42%) provided a general answer by mentioning that agricultural research has several priorities (food security, socio-economic situation, management of natural resources and environmental constraints), 25% of researchers considered that resilience to climate change is a research priority, 17% felt that the management of natural resources should be of primary interest to agricultural research, 8% found that crop improvement is a necessity for research, and 8% mention that agricultural research should focus on reducing inputs and energy. The researchers were then asked about the adaptation of agroecology to the current agricultural context. 50% of the researchers think that agroecology is perfectly adapted to the current agricultural context, 33% of the researchers mention that agroecology is not adapted to the current context since the current trends are rather aimed at increasing yields while 17% of the researchers believe that the idea of agroecology is partially adapted to the agricultural trends of the country. All researchers agreed that agroecology is a necessity for agricultural development. Nevertheless, this practice faces several obstacles that were mentioned by the researchers: 42% mention several obstacles to AE (technical, political, land, financial obstacles, etc.), 42% of the researchers indicate that they are political obstacles and 16% think that they are rather technical obstacles. In order to better understand the researchers' understanding of agroecology, they were asked for their views on the enabling factors for the development of agroecology. The majority of researchers (42%) say that the adoption and application of agroecology essentially requires the awareness of farmers and consumers about the need to change cropping systems towards a more environmentally friendly system, 17% consider that the context of climate change is a favourable factor for transitioning to agroecology and 17% affirm that a regulation in favour of organic farming promotes agroecology; 25% were not specific in their answers. When asked about their knowledge of agroecological practices, 67% of farmers indicate several practices (manure use, irrigation, rotation), 25% mention permanent soil cover and 8% indicated the general term of conservation agriculture. Finally, this group of researchers was asked for their overall opinion on the practice of agroecology, 68% are in total agreement for the adoption of EA in agricultural production systems, 16% totally disagree and finally 16% did not give a strong opinion.

The results of the survey carried out among NGO representatives

The surveys were carried out among non-profit organisations working on aspects of agriculture, environment and sustainability. The representatives of the NGOs questioned gave a definition of agroecology that can be summarized as follows: "Production systems that respect the environment". All representatives also affirmed that the practice of agroecology is a necessity in the current context due to the need to conserve biodiversity and ensure the sustainability of resources. In order to ensure the development of AE, 50% indicate the need for political support and continuous training in the field and 50% indicate the need for popularization and sensitization of the various actors on the importance of sustainability. The NGOs that participated in the survey have all had or are currently active in the field of agroecology, half have had training and support activities while the other half have activities concern the promotion of good agricultural practices. Regarding the impacts of agroecological practices, 50% mention that AE contributes very positively to the improvement of the value chain (agricultural production value chains are strengthened and structured with an encouragement to zero waste practices), while the other 50% report that AE intervenes in the restoration of biodiversity (water, soil, plant). Regarding the obstacles that the application of agroecology may encounter, the responses were very similar in the group and the different notions mentioned are: lack of knowledge, lack of expertise, high costs, resistance to innovation and ingrained habits. The majority of respondents gave very favourable opinions for the application of agroecology in production systems in general, indicating that the very promising results of these practices had been obtained.

The results of the survey of farmers.

A survey was conducted among farmers to find out their perception of agroecology. These farmers operate in the region of Siliana (50%), Sidi Bouzid (35.7%) and Ben Arous (12.5%). Sixty-two percent of farmers work on plots of less than 5 ha, 25 per cent on plots of 5-10 ha and 12.5 per cent on plots of more than 10 ha. The vast majority of farmers (75%) grow fruit in combination with market gardening, cereal cultivation or fodder crops. The rest of the farmers grow fruit trees (12.5%) or fodder (12.5%). Seventy-five percent of the farmers' production surveyed is destined for the local market, while the other 25% is used for farmers' own consumption. When discussing the concept of agroecology with these farmers, 50% defined it as "the integration of ecological principles in agriculture", 37.5% of farmers have no knowledge of this concept and 12.5% presented it as "absence of the use of chemicals". Farmers who claimed to have knowledge about agroecology acquired this knowledge either through projects in the region (50%) and practices adopted in the region (37.5%) or via the internet (12.5%). Farmers were also asked about the value of applying agroecological practices in production systems. The responses collected revolve around three aspects: improving soil fertility (37.5% of responses), maximizing the use of agricultural land (37.5% of responses) and reducing the impact of climate change (25% of responses). Explaining a little about the principles of agroecology, 62.5% said that it is a necessity in the production system while 37.5% indicated that it is a constraint due to mechanization problems. After discussing with farmers the concepts of agroecology and asking them about the possibility of adopting these practices on their farms, 50% of farmers indicated that they already have some agroecological practices adopted (zero tillage, manure input, reduction of phytosanitary treatments), 40% showed their interest in applying these practices but need support and agricultural advice. The rest of the farmers (12.5%) did not respond.

The results of the survey carried out among public officials.

These surveys were carried out among government officials. The interviewees gave a definition of agroecology which can be summarised as follows: 'Production systems that conserve natural resources and protect the environment'. Of those surveyed, 60% mention that AE is very well adapted to the current national context, while 20% think that these practices are moderately adapted to it. Twenty percent indicate that agroecology has no place in the current context in the country due to the lack of a regulatory framework that encourages agroecological practices. The representatives of the public authorities were then questioned on the integration of agroecology into the various agricultural public policies. The majority (60%) think that AE is a priority in current and future public policies to address climate change, while 40% indicate that AE is not a priority in policies since the current priority is water management and increasing productivity.

Regarding the policies that address this priority, 40% of the representatives questioned did not give a clear answer, 20% mention policies that encourage water and soil conservation, 20% indicate social inclusions related to agroecological aspects and 20% indicate regulations that encourage the adoption of agroecological practices. Respondents were also asked to provide guidelines that are close to agroecology, only 20% responded and indicated several orientations such as: encouragement of the use of compost, water management and subsidies for the installation and use of photovoltaic panels. The last part of the survey was dedicated to the obstacles and enabling factors for the development of agroecology. Regarding the obstacles, the answers were: risk of reduced returns (60% of responses), lack of mastery of innovations (20%) and difficulty of raising awareness combined with a low level of adherence (20%). Finally, for the favourable factors for the development of agroecology, 60% indicate that the need for the management of natural resources that the country is currently experiencing can be a very favourable factor for the integration of AE into production systems. Twenty percent of respondents indicate that the adoption of organic farming and the labeling of this practice encourages the adoption of different agroecological practices. The rest of the respondents indicate that the establishment of young, innovative start-ups working on the sustainability of systems is a very encouraging factor for the development of agroecology in the country.

9.5. Conclusion

Tunisia is facing several major challenges: climate change, the degradation of natural resources as a result of anthropogenic pressures and multiple global crises. It is becoming clear that a change in the development model and governance of natural resources is becoming urgent. In the various national strategies developed by the MARHP and the Ministry of the Environment (the CNTE, the new strategy for the development and conservation of agricultural land, the Water 2050 strategy, etc.), the awareness of the issues at stake on the part of the public authorities and the commitment to an agroecological approach are clearly visible. In this sense, a great effort is being made by the State to support, develop and diversify the organic farming sector, which is fairly well structured from production to export.

At the same time, the Ministry of Agriculture must face a major and urgent challenge, which is food security; To meet this challenge, it has put in place urgent and short-term programmes aimed at achieving self-sufficiency in durum wheat, red meat and milk by 2025, increasing yields of certain irrigated crops (tomatoes, potatoes) and increasing olive oil production. The actions needed to achieve these objectives (such as the monoculture

of durum wheat instead of the implementation of a rotation policy or the extension of irrigated areas reserved despite limited and non-renewable water resources) could run counter to the actions of soil rehabilitation, crop diversification or the rational management of resources advocated by the same ministry.

All these efforts to develop the agricultural sector and initiate an agro-ecological transition will remain incomplete due to the lack of a holistic and horizontal vision of the sector and the absence of real reforms based on an inclusive approach that will solve the structural problems and allow the gradual transition towards a more sustainable and equitable mode of production.

General Conclusion

General Conclusion

The diagnosis of the state of natural resources in North Africa reveals that they are inevitably degrading under the effect of multiple forms of overexploitation that sometimes threaten the equilibrium of certain agrosystems (mountains, oases, and arid zones). Rainfed agrosystems, which accounts for nearly four-fifths of the cultivated area in the North Africa region, will be particularly vulnerable to climate shocks. Between 2005 and 2020, North Africa experienced a temperature rise of +1.6°C, and a warming of 2°C or more above the pre-industrial average is expected to generate harsh climatic conditions that these countries have never experienced before. The variability and decrease in the level of precipitation recorded over the past decade has led to a decrease in the volume of water in the dams and hill reservoirs, especially in the case of the Maghreb. All North African countries have been overexploiting their available renewable water resources in recent years. Forecasts note that if climate change trends are not broken, there will be a near disappearance of the humid levels by 2100 in North African countries (Adapt'action Tunisia, 2022, IPCC, 2023).

Despite different contexts and natural and agronomic specificities, the five North African countries share many similarities, including the economic and social importance of the agricultural sector, food dependence to varying degrees, and the high level of vulnerability to climate change. The agricultural public policies that are being implemented today do not fully address the scarcity and/or fragility of natural resources in each country, and the degradation processes affecting arable soil and water are aggravated by ongoing climate change. This vulnerability calls into question an agricultural growth model that struggles not only to slow down the depletion of natural resources but also to ensure food sovereignty.

Similar strategic orientations are observed across these countries, with food security being a priority, emphasizing the increase in agricultural production to meet national needs and boost exports. Sustainable development and resource preservation are often geared towards maximizing agricultural production, for example, by changing irrigation methods to save water for the objective of irrigating more areas. However, there are often little or no connections between agricultural strategies and other strategies (environmental, climate change, health, etc.). Agroecology is not explicitly mentioned in the analysed national strategies (refer to section 3.2.1), although practices similar to agroecology can be observed among certain types of farmers, such as family farmers and small farmers in specific regions. The question at this stage would be whether these practices are more a continuation of traditional methods adopted out of necessity due to their lower costs. It should be noted however that a growing market for organic sector is reported. This indicates a growing demand for healthy and local products especially in the case of urban consumers who hold capable economic means.

The environmental dimension displayed in the five countries, which aims to promote sustainable development but is countered by a liberal framework that inspires public policies. Agricultural policy measures have encouraged a form of social organization (agricultural enterprise) that incentivizes the "mining" of resources. Rural development policies in North African countries during the 1980s and 1990s combined poverty alleviation measures with efforts to restore natural environments (against erosion, silting, or deforestation) and build specific infrastructure. These interventions, often driven by deconcentrated State extension and soil and water conservation services, have mainly taken place in fragile, arid, or mountain regions. Inaugurated by the Rio Earth Summit, 1992 was a pivotal and transitional year for North African countries. From this period onwards,

the latter are posting action programmes for sustainable development. They accede to international conventions, including the Convention to Combat Desertification (UNCCD), participate in Multilateral Environmental Agreements (MEAs), and proclaim their intentions to adopt the methods of Agenda 21 to develop ecological and sustainable territorial projects.

With the support of international institutions and NGOs, North African countries have developed institutional and legislative frameworks that integrate natural resource management into their strategic documents. States continue to be present in the governance of agreed programs, supported (particularly financially) by private structures, international cooperation agencies and/or institutions (FAO, WB, EU, GIZ, AFD, etc.), NGOs and regional bodies (examples of those would be the OSS and the CIHEAM). The decades from 2000 to 2020 were rich in terms of institutional and legislative innovations, with countries signing major international conventions (e.g., the United Nations Framework Convention on Climate Change, the Convention on Biodiversity, and ratifying the Paris Agreement), promulgating laws on water, forests, mountains, and biodiversity, and creating National Plans, Strategies, Agencies, and Observatories dedicated to sustainable development. These projects have mostly often benefited from international cooperation aid, especially since the Environmental Ministries were created following a period of structural adjustments with major stage budget reductions (UN, EU, AFDB, FFEM/AFD, etc.). Despite having the environment tackled by several national strategies and regulation, this sector is very much characterized by the involvement of organisations belonging to out-of-state administrations, especially international cooperation agencies, that fund and implement some elements of these strategies. In that sense, environmental action is driven by NGOs and international organisations and is implemented in pilot projects or in localised areas

Over the past few decades, it has been clear that the public policies promoted in these countries have officially given a place to the environmental dimension. Yet, the answers given by all interviews realised in partners countries show there are little or no training or research programmes that list agroecology as a priority measure. Yet, certain nuclei of relevant initiatives are starting to emerge, not only through projects with international cooperation agencies but also through national academic and research institutions (notably the novel Agroecological Centre at the ENA-Meknes, Morocco). Although countries include projects on their political agendas aimed at slowing down the degradation of their natural resources, they are nevertheless largely thwarted by the rise of an agricultural growth model that gives very little space to the environment and the climate. This is rather a remnant result of the dynamic, vision and the entire organization of States, their administrations, prioritized actions, and consistent organization of actors in the sector which date back to independence; whose effects continue today. This model of agricultural growth, adopted throughout North African countries, also stems from a general matrix inspired by structural adjustment plans adopted in the 1980s, which defines choices by emphasizing the revival of private and public investment and the development of strategic alliances with the national or international private sector. These choices, which entrust the future of the agricultural sector to private agricultural companies "with a high managerial capacity", advocate intensification in the use of natural resources and increased use of chemical inputs and agricultural equipment, choices made and virtually exported. Agroecology therefore does not enter as a national research priority, and consequently, there is little or no information on it especially in local contexts of weak or non-existent agricultural advice or extension services. Extension services are in fact yet to be introduced and trained on the concepts of agroecology. Projects with international organizations and NGOs are seen to hold a significant role in the

introduction of these concepts and in directly applying them in the countries. The question also lies in how national administrations could take advantage of these experiences to renew their skills and operating methods with stakeholders.

For now, and according to the agricultural growth model, food security remains the main objective mentioned in all public policy documents and is target to be achieved by increasing production. We should also acknowledge that information on agroecology adapted-to and emerging-from North Africa is still scares, and so cannot be labelled as the only solution especially in terms of guaranteed returns and yields. It is the lack of facts, evidence, and therefore of an operating model that is lacking to convince (including farmers). What is certain however is that the agricultural growth model promoted in the North African countries must be strongly questioned, because the objectives it has set itself as hardly compatible with an environmentally-friendly economy and with urgent needs to be implemented in order to ensure an ecological balance of agrosystems.

The analyses produced by the national studies show that not all national sustainable development strategies have been accompanied by sufficient obligations, incentives, or support in terms of training or advice for social actors. Additionally, the main orientations in the implementation of national strategies indicates that water resource management and increased production are priorities. What is clear however is that, given these national priorities, the concepts and approaches of agroecology is introduced through international cooperation projects or projects financed by international donors. This is where the few skills in agroecology are also found.

The strongest criticism of the limits of environmental measures displayed by the public authorities has also focused on the increase in production with an environmental component that is residual.

The analysis of public agricultural policies and the growth model that inspires them shows that areas with the most resourced farmers (soil and water) still benefit from budgetary or technical support from the public authorities. The public policy statement illustrates real contradictions between agricultural development and the preservation of critical natural resources such as water, soil, forests, or biodiversity. National reports have highlighted enabling factors for the transition to agroecology, with many agricultural practices identified within the small-sector and family farming. These include the diversification of cropping systems, the association of small-scale livestock farming with crop production, agroforestry development, low use of fertilizers and machinery, and direct marketing to local consumers. Also, even if new strategies do not explicitly mention agroecology, are in the process of implementation in line with some of the principles of agroecology (as per the HLPE). Organic farming is also on the rise in Tunisia and Morocco, and no-till practices with increasing use of farmers' seeds indicate progress towards more resilient and sustainable agriculture. Therefore, what can be seen is that, for now, the concepts of agroecology are being introduced and led by NGOs and civil societies with links to international cooperation and are progressively developing. So far, they are mainly local and specific in their contexts with no solid structure or transversality which limit the capacity of capitalizing on their results and experiences. Coupled with the lack of availability in local and regional scientific research, guidance remains limited on how agroecology, as combinations of practices, can concretely inspire public policies, and in turn producers and stakeholders, in the region nor within a specific frame or model.

On another level, interviews with stakeholders reveal a mixed perception of agroecology. Few farmers are aware of it, and it is generally perceived as necessary but risky due to potential decreases in production and income, especially in the absence of an alternative, localized scientific model that guarantees similar production levels.

Yet, multiple barriers exist with impeding influence against the implementation of agroecology. These mainly include (i) the urgency of food security challenges (and other urgent short-term challenges) and the fragility of the agricultural sector within no true political will, (ii) the little or no accumulation of scientific knowledge and cognitive capital on agroecology as a comprehensive approach, and (iii) a certain ambivalence towards agroecology because, on the one hand, it is necessary to preserve the environment, and on the other hand, the transition to agroecology is still at an unknown cost for the actors.

Ultimately, the question remains of ensuring better convergence between agricultural public policies and environmental strategies. It involves reconciling short- and medium-term measures aimed at food security with long-term environmental strategies. Achieving food security while promoting economic management of natural resources is a major challenge for North African countries, necessitating an agricultural growth model that challenges the agro-export orientation influencing the exploitation of soil and water resources.

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Appendixes

Appendixes

Appendix 1. Grid of analysis

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NATAE North African Transition to AgroEcology

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Fostering agroecology transition in North Africa through multi-actor evaluation and networking

T6.1 Inter-sectoral Public Policy Review
Letter addressed to Living Lab leaders

Montpellier, 19 July 2023

Dear NATAE Living Lab leaders,

This letter is addressed to you to announce that, with the launching of the T6.1 of the NATAE project (Inter-sectoral policy review), a grid of analysis has been prepared to include a list of guiding questions. You are accordingly kindly asked to commence the collection of relevant information needed on the existing policy in your corresponding Living lab territory and their analysis following this grid.

Objectives of T6.1: to improve the understanding of public policies as a context for the practice of agroecology in North Africa and which could thus constitute either obstacles to the adoption of agroecology, or levers favorable to its development.

Methodology of analysis: the proposed analysis grid is based on a combination of the main approaches to public policy analysis (analysis of actors, institutions, public choices, etc.). It is a starting point for producing an initial analysis which will be nourished and supplemented by exchanges and debates with partners through the organization of several workshops.

Next steps: A series of Ateliers will be organized during which the methodology will be explained, your questions answered, and, in future ateliers, your findings formulated and presented.

Atelier 1: Internal session of Questions and Answers on the methodology and quick country-based slideshow presentations on the first policy elements available made by each country representative (nominated prior by the NATAE Living Lab leaders). Expected date: September 2023

Atelier 2: Country slideshow presentations on the first set of (preliminary) results including external attendees if needed made by each country representative. Expected date: December 2023

Submission of written reports: Country representatives to submit a written report (i.e., filled grid of analysis) on the findings collected. Expected date: January 2023

Atelier 3: Feedback and discussion of the findings of the written report. Expected date: January 2023

As a first step, country representatives nominated by the Living lab leaders are expected to commence their contribution to meet the objectives of Atelier 1. Further details will follow soon on the exact date.

Thank you in advance.

Team T6.1

For your questions:

1. T6.1 Lead research experts: Tahani AbdelHakim (abdelhakim@iamm.fr) and Omar Bessaoud (bessaoud@iamm.fr)
2. T6.2 post-doctoral researcher: Rita Jalkh (jalkh@iamm.fr)

Introduction:

Objectives of the work: to understand public policies as a context for the practice of agroecology and which could thus constitute either obstacles to the adoption of agroecology, or levers favourable to its development.

Methodology: the proposed analysis grid is based on a combination of the main public policy analysis approaches (analysis of actors, institutions, public choices, etc.). It is a starting point for producing an initial analysis which will be nourished and supplemented by exchanges and debates with partners through the organization of several workshops.

Reminder of the definition of agroecology in the context of the NATAE project (see table in the appendix): The agroecology referred to is part of a scientific debate resulting from knowledge relating to soil life , plants, on farming practices (particularly in areas marked by aridity or subject to climate risk), plant and animal genetics, health-food relations, the development of rural territories, the reproduction of wealth and the mastery by the producers of their products, food security/sovereignty….

If agroecology is inspired by the teachings of modern agronomy and ecology, it also aims at the rehabilitation of farming knowledge and know-how, at a collective reappropriation of the capital of local varieties better adapted to the great diversity of farmers' fields, to skilful agricultural practices advocating natural fertilization by combining pulses or fodder with cereal crops, developing small-scale sheep or cattle farming on farms, diversifying cropping systems giving room for food production, leading to an ecological intensification of crops, as autonomous as possible in relation to imported industrial inputs. However, agroecology is not just a set of farming practices that respect the environment and human health. Its object is not only to take care of the soil, the plant, the animal or the human being, but also to consider all the elements of the ecosystem and social systems and to ensure the quality of their interrelationships. Agroecology often encourages local actors (citizens, researchers, farmers, civil servants, cooperatives, NGOs), etc., who are used to acting individually, to work together. The agroecological project involves pooling the experiences and knowledge of farmers in the same territory, greater cooperation between actors to pool knowledge and know-how, discuss practices, reduce the costs of labour, enhancing production by strengthening links with consumers (through the creation of short circuits, development of farmers' markets.) … The agro-system is an ecosystem which has the particularity of being inhabited by human question the social, economic or cultural dimensions of the spaces they occupy. The men who occupy these spaces are not simple users of ecosystem services but an element of this agro-system. From then on, human factors become ecological factors. Issues such as work, market access, social conditions of life become ecological factors and, in this respect, must be taken into account along with the activity of soils and plants. This remark aims to highlight that agroecology does not simply have an exclusively technical dimension (relating to the links between agronomy and ecology): the studies that will be undertaken will also take care to emphasize this socio-economic dimension.

Producing more with less water is both a scientific and societal challenge. We must learn to cultivate as much as possible with a minimum of water resources used. Agroecology is a response that is specially adapted in arid regions, where on soils deemed to be difficult, where water and organic matter resources are little available It strives to produce at lower cost and with less energy, by prohibiting any use of chemical fertilizers, pesticides and by optimizing the use of water resources. **We**

also seek to limit the use of fossil fuels as much as possible by reducing mechanization. One of the key principles of agroecology is the diversification of cropping systems and the association of agriculture and livestock and/or the development of mixed cropping and livestock systems. Over the seasons, the cultures alternate and, thanks to the cultural practices, this intense succession of cultures contributes to enrich the soils, to balance them, and makes it possible to increase the biodiversity (fauna and flora) present in the soils. This system thus makes the soil more resistant to the sometimes violent climatic changes in arid zones. The farmer's vulnerability to drought will depend on the production systems, the varieties selected, the farming practices including not only the tillage techniques but also the sowing date. Another lever in response to increasing aridity always consists in maximizing the stock of "green" water in the soil, thanks to conservation practices, or water management using the association of trees and crops. market gardening (agroforestry).

3. Components of the grid:

Below are the components of the grid which provides a common framework for analyzing public policies in the sectors of agriculture, environment, research and training.

I- Elements of context:

- Quick reminder of the main characteristics of agriculture in the country
- Constraints and challenges in the field of agricultural production (for example: need to increase production to meet growing demand), food security (for example: dependence on grain imports), food safety for health (for example: non-standard level of pesticide residues in agricultural products following the massive use of pesticides), the impacts of climate change (for example: drop in rainfall, frequency of drought periods and consequences on production), and pressure on natural resources (example: land degradation, depletion of water resources.)

II- Inventory of existing strategies and documents:

a. agricultural development strategy (title and start and end dates)
b. environmental strategies (title and start and end dates)
c. climate change adaptation strategy (title and start and end dates)
d. strategy for research and training (title and start and end dates)

This involves identifying existing strategies at national and regional level (i.e. sub-national level) and explaining the regional level: department level, or governorate or wilaya for example?

III- Analysis framework for each strategy:

- What are the **orientations, priorities and objectives** announced in the strategy document?
- What place is given to **agroecology in the strategy**? is it mentioned explicitly? and if so what is its definition? How is it approached and from what angle? (for example from a technical angle linked to the preservation of a resource such as water or soil).
- Identification of orientations and objectives related to agroecology
- The **categories targeted**: small farmers, large agricultural enterprises, collective structures such as cooperatives, etc.
- **The actors involved**
    - Actors responsible for implementation (public institutions such as ministries, or cooperatives, national or international NGOs, international institutions)
    - Partner actors (for example one or more other ministries, specialized offices, etc.)

- **The implementation** of the orientations and the declared objectives in the field of agroecology:
    - Programs specifically formulated to achieve one or more objectives (listing of these programs, titles, durations, institutions involved, actors targeted, activities planned, and resources mobilized)
    - Projects (list of these projects, titles, durations, institutions involved, actors targeted, activities planned, and resources mobilized)
- **The means mobilized** for the implementation: origin of the financing (national or international or mixed); % of budgets allocated to agroecology in total budget (e.g. % of agroecology research budget in total agricultural research budget)
- **Orientations and/or policies which represent an obstacle to the development of agroecology or which are in contradiction with its principles:** for example: the promotion of specialized crops for export, the development of exploitation of groundwater, the massive use of industrial seeds, the lack of skills, the lack of support for farmers in terms of technical advice or other form of support, etc.

IV- Skills and information

- What types of skills exist in the field of agroecology? scientific skills (researchers, trainers, specialized department in universities or research centres), technical skills (extension agents, engineers)
- Where are the skills? research centres, cooperatives, NGOs, extension centres, private institutions…etc.
- Information on agroecology: what types of information and on what subjects (examples: tillage, insect control, etc.), who produces this information? where are they? are they accessible and in what form (scientific publications, website, leaflets, etc.)?

V- V- The perception of agroecology among the different categories of actors:

- Consists of questioning representatives of different categories of actors on their perception of agroecology and this around the following axes:
    - Knowledge of the subject
    - And if so; what does agroecology mean
    - How is it envisaged? a constraint? a necessity?
    - If it is a necessity, why? and if it is a constraint why?
    - What are the risks and benefits of practicing agroecology?
    - What are the needs for adopting agroecology?
- The actors to be interviewed: farmers (different types of farmers), researchers, representatives of collective structures (cooperatives, chamber of agriculture), extension workers, representatives of public institutions (ministries and others, etc.), NGOs.

Annex:

Elements and principles of agroecology according to the FAO and the HLPE

Elements according to the FAO	*Definition according to the FAO*	*Elements according to the HLPE*	*Definition according to the HLPE*
Improving efficiency and building resilience			
1. **Recycling**	Reduced economic and environmental costs of agricultural production.	1. **Recycling**	Use of local renewable resources
2. **Diversity**	Improving food security and nutrition while conserving, protecting and enhancing natural resources.	2. **Biodiversity**	Optimization of the diversity of agricultural and biological natural resources.
3. **Resilience**	Resilience of people, communities and ecosystems (in the face of possible disturbances including extreme climatic events such as droughts, floods or hurricanes and in the face of attacks by pests and diseases) essential to sustainable food and agricultural systems.	3. **Economic diversification**	Diversification of production for an improvement of the socio-economic situation and financial independence of small farmers.
4. **Efficiency**	Innovative agroecological practices make it possible to produce more using fewer external resources.	4. **Input reduction**	Limiting the use of chemical inputs and increasing self-sufficiency.
		5. Soil health	Improved soil health (organic matter and biological activity) to ensure better plant development.
5. **Synergies**		**6. Animal health**	Ensuring better animal health and welfare.
	Enhancement of essential functions within food systems as they support production and multiple ecosystem services.	7. **Synergy**	Improvement of ecological interactions and complementarities of the different elements of agrosystems.
Ensuring fairness/social responsibility			
6. **Co-creation and sharing of knowledge**	Knowledge-based agricultural innovations are co-developed through participatory processes.	**8. Co-creation of knowledge**	Reinforcement of exchanges and sharing of knowledge and know-how (local, scientific, innovations, etc.).
7. **Culture and food tradition**	Promoting healthy, diversified and adapted diets culturally by preserving the health of ecosystems.	**9. Social values and diets**	Building food systems based on local cultures and identities.
8. **Human and social values**	Protection and improvement of rural livelihoods, equity and social well-being.	**10. Fairness**	Ensure dignified and robust livelihoods for all actors including smallholder farmers.

9. Circular and solidarity economy	Restoring the link between producers and consumers, establishing the social foundations for inclusive and sustainable development.	**11. Connectivity**	Ensure proximity between producers and consumers (short and fair circuits).
10. Responsible governance	responsible and effective governance mechanisms at different levels (local, national and global).	**12. Land and natural resource governance**	Strengthening of institutional mechanisms towards the support and involvement of all actors and towards adaptive local management of agrosystems.
		13. Participation	Better organization and social participation.

Source : (Boughamourra et al., 2022)

Appendix 2. Stakeholder interview guide

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T6.1 Inter-sectoral Public Policy Review

English version

Interview Guide

The guide contains the topics to be addressed for each category of actors. Each subject will be discussed and explored in depth during the interview through a series of questions to be formulated by the interviewer.

The objective is to know the perception of each category of stakeholders and to compare these perceptions in order to identify the factors favourable or unfavourable to agro-ecology.

It is necessary to identify the representatives of each group of actors interviewed:

- *Farmers; specify the region, the cultivated area or the size of the farm, the main crops, and the destination of the production (local market, export, etc.)*
- *Professional agricultural Organizations: the type of organization, the position occupied by the person, the region, the activities.*
- *Researchers: the institution, the position of the person, the area of specialization.*
- *NGOs: the name of the NGO, the field of activity, the region, the position of the person, the origin of the members of the NGO (executives, farmers, etc.)*
- *Representatives of ministries: position of the person, field of activity.*

1. **Farmers** (representatives of different categories: small family farming, large exporting farms, etc.)
   - Knowledge of the subject: what is agro-ecology? how do we define it? by what means did the farmer learn about agro-ecology?
   - What is the point of agro-ecology?
   - Is it a constraint? or a necessity? and why?
   - Agro-ecological practices: are there agro-ecological practices on the farm?
     - if yes which ones? and why? and what are the constraints and advantages, what are the impacts? what are the needs in terms of support (agricultural advice, etc.)
     - and if not why? and what are the needs and conditions necessary for the implementation of these practices?
   - What are the obstacles to the adoption of agro-ecology at the farm level? information? economic risk? the techniques? other?

If the term agro-ecology is not known, it will then be necessary:

- Formulate the questions in such a way as to evoke the practices and meaning of agro-ecology.
- Ask the farmer about practices from traditional knowledge: the practices he knows, those he adopts and the benefit of these practices or the reasons why he does not implement them.

2. **Representatives of professional agricultural organizations (cooperatives, producer groups, chambers of agriculture, etc.)**
   - What is agro-ecology? how do we define it?
   - How did you discover agro-ecology? and since when?
   - Can agroecology provide answers to the challenges of agriculture in the region? if yes why and if no why?
   - What are the factors favourable to its development?
   - What are the obstacles to its development? technical, political, institutional obstacles, etc.
   - what are the needs for the development of agro-ecology? more information? technical advice? political support?
   - What perception do farmers have on this subject?
   - To their knowledge, are there any agro-ecological experiences or practices? and if so in which region? and what are these practical? and who are the actors involved?
   - What is their opinion and evaluation of these experiences?

3. **Researchers (of different specializations):**
   - What is agro-ecology?
   - Is agroecology a subject of agricultural research? And if so, why? and if not why?
   - What are the priorities for agricultural research?
   - Is agro-ecology adapted to the national agricultural context? if yes why and if no why? is this a constraint and if so why?
   - Is it a necessity and if so why?
   - What are the obstacles to its adoption? technical, political, institutional obstacles, etc.
   - Are there factors favourable to its development?
   - What are the conditions necessary for its development? for example means for research, policy reform, etc.
   - To their knowledge, are there any agro-ecological experiences or practices? and if so in which region? and what are they? and who are the actors involved?
   - What is their opinion and how does he evaluate these experiences?

4. **NGO representatives:**
   - What is agro-ecology?
   - How did you discover agro-ecology? and since when?
   - Is it a necessity or a constraint? and why?
   - Do you have activities in the field of agro-ecology? if not why?
   - If yes, what are these activities? and what practices do they concern? in which region? and with what type of farmers? and since when?

- What are the impacts of these practices? on a technical, economic, social level, etc.
- What are the difficulties and/or obstacles that you encountered? on a technical, economic, institutional, social or other level.
- What is their opinion and how does he evaluate these experiences?
- What are the factors favourable to the development of agro-ecology?
- What are the needs? technical advice, training, political support

5. **Representatives of public authorities (responsibles involved in the development of policies at the Ministry of Agriculture and the Ministry of the Environment):**
   - What is agro-ecology? how do you define it?
   - Is it adapted to the national context? if yes, why? and if not, why?
   - Is it a public policy priority? if yes, why? what are the challenges it can respond to?
   - What are the policies or measures that decline this priority? and in what areas?
   - If it is not a priority, are there guidelines or policies that are similar to agro-ecology? and if so which ones and in what area?
   - What are the constraints and obstacles to the development of agro-ecology? on a technical, economic, social, institutional level…
   - What are the factors favourable to its development?

Appendix 3. Template of the country reports

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T6.1 Outline of the Report

A general introduction to macroeconomic and social data, demographic data in the country

1. **Background**
   - 1.1 The main indicators relate to agriculture (GDPA, agricultural employment, exports, in state budget expenditures) the agri-food sector (share in GDP or PV and employment).
   - 1.2 The state of natural resources (total UAA, irrigated). The state of agrarian structures (based on the latest censuses).
   - 1.3 The main agricultural products
   - 1.4 Constraints and challenges
     - 1.4.1 Climate Change and Threats
     - 1.4.2 Anthropogenic pressure and degradation of natural resources (land, water and biodiversity)
     - 1.4.3 Agro-climatic and technical constraints (performance and limitations of the technical systems used)
     - 1.4.4 Food dependency and the state of coverage of nutritional needs by national production.
     - 1.4.5 The crisis in world markets (rise in the prices of inputs, imported raw materials) and its effects (price inflation, rising food bills, etc.)
     - 1.4.6 The challenges and issues of the future:

- The reclamation of soils and the preservation of **waters:** increased pressure on natural resources can be a source of social conflicts over their use and uncontrolled migration.
- Rational use of natural resources (soil, water, forests, biodiversity) contributes to the construction of controlled agricultural systems and to the balance of rural territories.
- The issues at stake are also those of food sovereignty, public health and dignified living conditions.

2. **Strategies adopted**
   - 2.1 Definition of the agricultural strategy based on the latest documents published by the public authorities
   - 2.2 Environmental strategies based on official documents
   - 2.3 Key climate change adaptation measures adopted
   - 2.4 The main measures adopted to preserve natural resources (land, water and biodiversity)
   - 2.5 The main orientations in terms of research and training, the indicators (number of researchers, staff trained, budget mobilised) and their shortcomings
3. **Analysis of the strategies adopted and the role of agroecology**
   - 3.1 The dynamics of agricultural growth in the main branches of production, evoking the extension of productive capacities (land reclamation, mobilization of water resources, etc.), and the means mobilized to achieve them.
   - 3.2 The place given to agroecology in agricultural strategy papers: is it mentioned, how, and are objectives set for the ecological transition of the agricultural sector?...
   - 3.3 Weak signals evoking or promoting agroecology in the country: emergence of actors and/or associations for the promotion of agroecology, learned practices of small farmers or young agricultural entrepreneurs, favourable technical itineraries (direct seeding,

crop diversification, agroforestry, reduction in input consumption, use of traction and manual work, etc.), organic farming, etc.

3.4 What skills and information do you have in the field of agroecology? :

Scientific skills (researchers, trainers, specialized department in universities or research and extension centers), technical skills (extension workers, engineers). Skills at the level of cooperatives, NGOs, private institutions, etc. etc.

3.5 Barriers to agroecology:

Incentives and incentives for the use of the intensive technical model, agricultural exports and trade policies, support for the use of fertilizers and mechanization...

Technical obstacles: level of techniques impacting agricultural yields and productivity, supervision by training and research institutions, etc.

Lack of information (lack of knowledge on agroecology, lack of research and training of actors in agroecology, etc.)

4. Main results of the stakeholder interview guide

4.1 The methodology used (natural regions, production systems, types of farmers, etc.)

4.2 Stakeholders' responses:

- Farmers (with different categories, small family farms, large exporting farms, etc.)
- Representatives of professional agricultural organisations (cooperatives, producers' groups, chambers of agriculture, etc.)
- Researchers (of different specializations)
- NGO representatives
- Government representatives (officials involved in policy development at the Ministry of Agriculture and Ministry of Environment

General Conclusion and Brief Bibliography

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Funded by the European Union

This project is funded by the European Union under the Grant Agreement no. 101084647. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them. For the associated partner in the NATAE project, this work has received funding from the Swiss State Secretariat for Education, Research and Innovation (SERI).

Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI